This is the Courses section (Accounting through Education and Human Development) of the 2005-2007 Graduate School Catalog for the University of Minnesota.
The courses in this catalog are not offered every semester. For a listing of courses offered in a particular semester, consult the Class Schedule at http://onestop.umn.edu/onestop/registration.html.

**Course Numbers**—Courses numbered from 5000 to 5999 (listed as 5xxx if individual course number is unspecified) are primarily for graduate students, but are also open to third or fourth year undergraduate students. (5xxx courses in the School of Dentistry and in some clinical departments of the Medical School may not be applied to graduate programs.) Courses numbered 8000 or above (8xxx) are open to graduate students only.

Courses at the 6000 (6xxx) and 7000 (7xxx) levels are for postbaccalureate students in professional degree programs not offered through the Graduate School. Courses numbered at the 4000 (4xxx) level are primarily for undergraduate students in their fourth year of study. 4xxx, 6xxx, and 7xxx courses may be applied toward a Graduate School degree with approval by the student’s major field and if the course is taught by a member of the graduate faculty or an individual authorized by the program to teach at the graduate level. For course descriptions for 4xxx, 6xxx, and 7xxx courses, consult the list of University courses at http://onestop2.umn.edu/courses/index.html.

Courses at the 1000 (1xxx), 2000 (2xxx), and 3000 (3xxx) levels are for undergraduates and may not be applied to graduate programs. Courses numbered 0000 to 0999 do not carry credit.

**Course Designators**—In conjunction with course numbers, departments and programs are identified by a 2-, 3-, or 4-letter prefix known as a designator (e.g., CE for Civil Engineering, Pol for Political Science, WoSt for Women’s Studies). When no course designator precedes the number of a course listed as a prerequisite, that prerequisite course is in the same discipline as the course being described.

**Course Symbols and Abbreviations**—The following abbreviations and symbols are used throughout the course descriptions of most University catalogs to denote common and recurring items of information.

- **Prereq** ...............Course prerequisites.
- **cr** ......................Credit.
- **1-4 cr [max 6]....** The course can be taken for 1 to 4 credits and may be repeated for up to 6 credits.
- **!** .......................Work for this course will extend past the end of the term. A grade of K will be assigned to indicate that the course is still in progress.
- **†** .......................All courses preceding this symbol must be completed before credit will be granted for any term of the sequence.
- **§** .......................Credit will not be granted if credit has been received for the course listed after this symbol.
- **¶** .......................Concurrent registration is required (or allowed) in the course listed after this symbol.
- **#** .......................Approval of the instructor is required for registration.
- **Δ** .......................Approval of the department offering the course is required for registration.
- **,** .......................In prerequisite listings, comma means “and.”
- **DGS** ....................Director of graduate studies.
- **W** .......................Following a course number, the W indicates the course is writing intensive.

-The courses in this catalog are current as of March 18, 2005.
Check online at http://onestop2.umn.edu/courses/index.html for the most current course information.
Courses

Accounting (Acct)

Department of Accounting

Curtis L. Carlson School of Management

Acct 5100. Corporate Financial Reporting. (4 cr; A-F only. Prereq—mgmt student, non-accounting major)
Overview of asset/liability valuation and income measurement. Focus on how economic events are reported in the financial statements. Examines accounting theory and the accounting standard-setting process.

Acct 5101. Intermediate Accounting I. (4 cr; A-F only. Prereq—Grade of at least B- in 2500, [mgmt major or mgmt grad student])
Valuation, measurement, and reporting issues related to selected assets/liabilities of a firm. Theory underlying accounting issues. Applying accounting principles.

Acct 5102. Intermediate Accounting II. (4 cr; A-F only. Prereq—5101 [mgmt or grad mgmt student])
Basic valuation problems encountered in financial reporting. Focuses on valuation of liabilities. Accounting for leases, pensions, and deferred taxes. Introduces consolidated financial statements.

Acct 5125. Auditing Principles and Procedures. (4 cr; A-F only. Prereq—[3101/5101 or 5100/6100], [accounting major or grad management student])
Auditing financial information systems. Independent audits and internal auditing. Ethics. Legal responsibilities.

Acct 5126. Internal Auditing. (2 cr; A-F only. Prereq—[3101/5101 or 5100/6100], 3001)
Financial and operational auditing. Standards. Managing the function.

Acct 5135. Fundamentals of Federal Income Tax. (4 cr; A-F only. Prereq—[2050 or MGA 6030], [mgmt or grad mgmt student])
U.S. federal system of taxation. Concepts of gross income, deductions, credits. Analysis of structure of Internal Revenue Code, its provisions with respect to specific areas of law. Interrelationships between legislative, judicial, and administrative authority. Methods, tools, and techniques to conduct tax research.

Acct 5160. Financial Statement Analysis. (2 cr; A-F only. Prereq—5100/6100 or 3101/5101, [accounting or finance major])
Interpretation/analysis of financial statements. Introduces basic techniques of financial statement analysis and applies them in different settings (e.g., in investment/credit decisions).

Acct 5180. Consolidations and Advanced Reporting. (2 cr; A-F only. Prereq—5102, mgmt or grad mgmt student)
Theory underlying the preparation of consolidated financial statements, as well as the mechanical computations needed to prepare the statements themselves.

Acct 5236. Introduction to Taxation of Business. (2 cr; A-F only. Prereq—5135, acct major)
Introduction to the income tax laws governing the taxation of corporations, partnerships, limited liability companies, limited liability partnerships, and S corporations. Students will also increase their knowledge and skills related to tax research by writing research memorandums.

Acct 5271. Accounting Information Systems. (2 cr. Prereq—3101/5101 or 5100/6100)
Applications of electronic data processing systems in accounting, including modeling, financial planning, auditing, and data security. Analysis/design of accounting information systems.

Acct 5281. Special Topics in Financial Reporting. (2 cr; A-F only. Prereq—5102, [mgmt or grad mgmt student])
Covers areas of financial reporting frequently covered on the CPA exam, including partnerships, foreign operations, and accounting for government and nonprofit organizations.

Acct 5310. International Accounting. (2 cr; A-F only. Prereq—2050, mgmt student)
Review of macroeconomic concepts of international economics, including trade, international markets for capital, and the role of accounting. Survey of different accounting policies and approaches among nations. Reading and understanding financial statements produced in countries other than the United States.

Acct 5320. Current Topics in Accounting. (2 cr; A-F only. Prereq—5120, acct major, #)
Topics vary.

Acct 8801. Empirical Research in Capital Markets. (4 cr. Prereq—Business administration PhD student or #)
Econometric studies of information contained in accounting numbers; volume and price reactions to accounting disclosure; earnings management; accounting based valuation; market microstructure.

Acct 8802. Emerging Issues in Accounting. (4 cr [max 8 cr]. Prereq—Business administration PhD student or #)
Topics vary.

Acct 8811. Information Economics I. (4 cr. Prereq—Business administration PhD student or #)
Asymmetric information, incentives, and contracts. Moral hazard, adverse selection, reputation, and signaling phenomena. Applications to accounting such as transfer pricing, budgeting, cost allocations, performance measurement, audit pricing.

Acct 8812. Information Economics II. (4 cr. Prereq—Business administration PhD student or #)
Information in capital markets; asset pricing with asymmetric information; economics of disclosure and information acquisition.

Acct 8821. Experimental Economics. (4 cr. Prereq—Business administration PhD student or #)
Auction markets; price formation in experimental asset markets; experimental studies of information transfer and capital market efficiency; experimental tests of strategic behavior, trust, and reciprocity.

Acct 8822. Behavioral Research in Accounting. (4 cr. Prereq—Business administration PhD student or #)
Heuristics and biases in information processing, auditor judgment, mental accounting, and decision aids.

Acct 8892. Readings in Accounting. (1-8 cr [max 16 cr]. Prereq—Business administration PhD student or #)
Readings appropriate to an individual student’s program or objectives that are not available in regular courses.

Acct 8894. Research in Accounting. (1-8 cr [max 16 cr]. Prereq—Business administration PhD student or #)
Individual research on an approved topic appropriate to student’s program and objectives.

Adult Education (AdEd)

Department of Work, Community, and Family Education

College of Education and Human Development

AdEd 5001. Survey: Human Resource Development and Adult Education. (3 cr. [HRD 5001]
Overview of fields of human resource development and adult education. Includes societal context, systems theory, processes, definitions, philosophies, goals, sponsoring agencies, professional roles, participants, and resources. Emphasis on the unique characteristics and ways the fields overlap and enhance one another.

AdEd 5101. Strategies for Teaching Adults. (3 cr; A-F only)
Psychological theories of adult learning; learning styles and personality types; teaching styles; group and team learning; moderating and study circles; teaching technologies and distance learning; gender, race, and cultural communication. Applications of strategies.

AdEd 5102. Perspectives of Adult Learning and Development. (3 cr)
Emphasis on major adult development theorists, theories, and current applications. Transformative learning, self-directed learning, experiential learning, and cooperative learning projects. A theoretical framework for exploring physiological, psychological, sociological, and cultural aspects of adult development through the life span.

AdEd 5103. Designing the Adult Education Program. (3 cr; A-F only)
Designing and implementing educational programs for adults. Application of concepts, theories, and models in different adult learning situations.

AdEd 5106. Field Experience in Adult Education. (1.5-6 cr [max 6 cr]; S-N only)
Supervised fieldwork and practice. Presentations and evaluations of adult education practices.

AdEd 5201. Introduction to Adult Literacy. (3 cr)

AdEd 5202. Assessment of Adult Literacy. (3 cr. Prereq—§ 5224, 5225, 5226)

AdEd 5203. Methods of Teaching Adult Literacy. (3 cr)

AdEd 5211. Introduction to the Undereducated Adult. (1 cr; A-F only)
Definitions of literacy in workplace, community, and family. Issues: poverty/welfare, ethnicity, cultural diversity, social class, language/learning, immigrants.

AdEd 5212. Introduction to Adult Literacy in the Workplace. (1 cr; A-F only. Prereq—5211)
Review workplace literacy programs, funding, program planning, and needs assessment. Reaching/recruiting workers. Role of employers and the unions. Writing for low literacy employees.

AdEd 5213. Introduction to Adult Literacy in the Community. (1 cr; A-F only. Prereq—5211)
Reviews role of the community programs in the United States in literacy building, the family in developing literacy skills, correctional education in reintegrating offenders back into community. Integrating people with disabilities through community literacy programs. Literacy/development in developing countries. Reaching/recruiting indigenous, migrant, and immigrant groups. Social action approaches to literacy education.

AdEd 5224. Formal Assessment of Adult Literacy. (1 cr; A-F only. Prereq—5211)
Assessment of adult English/literacy skills needed for work, family, community, and continuing education. Formal testing policy, techniques, standardized tests. Underlying assumptions about testing, cultural bias, and interpretive leaf for tests. Test preparation programs.

AdEd 5225. Informal Assessment of Adult Literacy. (1 cr; A-F only. Prereq—5211)
Informal assessment of adult English/literacy skills for work, family, community, and further education. Informal testing techniques, setting educational goals, formal versus informal assessment.

AdEd 5226. Advanced Assessment of Adult Literacy. (1 cr; A-F only. Prereq—5211, 5224, 5225)
Applications and case studies. Educational planning for work, family, and community.
AdEd 5233. Methods of Teaching Beginning Adult Literacy. (1 cr; A-F only. Prereq—5211) Learning English and literacy as an adult: initial approaches to teaching reading, writing, and communications skills. Theories of learning and curriculum design. Technology as a teaching tool: teaching students with disabilities or with cultural gender differences.


AdEd 5235. Methods of Teaching Advanced Adult Literacy. (1 cr; A-F only. Prereq—5211, 5234) Advanced approaches to teaching reading, writing, and communication skills. Preparing students for college and continuing education. Reading/study skills. English in workplace and on Internet. Problem solving, analytical thinking. Technology as teaching tool. Evaluating commercial material/software.

AdEd 5302. Continuing Education for Professionals. (3 cr) Analysis of philosophies, issues, policies, trends, professional needs and statutory requirements in continuing professional education programs. Role of the program director and organization.

AdEd 5303. Working with Volunteers in Community Settings. (3 cr) Uses collaborative, experiential methods to address fundamental issues and practices in volunteer development. Explore personal philosophies, staffing, and key issues and trends in the administration of volunteer programs.

AdEd 5401. Distance Learning in Adult Education and Training. (3 cr; A-F only. HRD 5401) Distance learning concepts, theory, history, present practice, delivery systems, course design, major issues, and future directions.


AEM 5495. Topics in Aerospace Systems. (1-4 cr [max 4 cr]; A-F only. Prereq—5221) Topics of current interest. Individual projects with faculty sponsor.

AEM 5501. Continuum Mechanics. (3 cr. Prereq—IT upper div or grad, 3031, Math 2243 or equiv or §) Concepts common to all continuous media; elements of tensor analysis; motion, deformation, viscosity, material derivatives; mass, continuity equation; balance of linear, angular momentum; geometric characterization of stress; constitutive equations.

AEM 5503. Theory of Elasticity. (3 cr. A-F only. Prereq—4501 or equiv, Math 2263 or equiv or §) Introduction to the theory of elasticity, with emphasis on linear elasticity. Linear and nonlinear strain measures, boundary-value problem for linear elasticity, plane problems in linear elasticity, three-dimensional problems in linear elasticity. Topics from nonlinear elasticity, micromechanics, contact problems, fracture mechanics.


AEM 6000. Seminar: Aerospace Engineering and Mechanics. (1 cr [max 4 cr]; S-N only. Prereq—GSG consent) Mathematical and physical principles governing the motion of fluids. Kinematic, dynamic, and thermodynamic properties of fluids; stress and deformation; equations of motion; analysis of rotational and irrotational inviscid incompressible flow; two-dimensional and three-dimensional potential flow.

AEM 6022. Fluid Mechanics II. (3 cr. Prereq—8201) Analysis of incompressible viscous flow; creeping flows; boundary layer flow.

AEM 6023. Fluid Mechanics III. (3 cr. Prereq—8201 or equiv, Math 2263 or equiv) Mathematical and physical principles governing the motion of fluids. Kinematic, dynamic, and thermodynamic properties of fluids; stress and deformation; equations of motion; analysis of rotational and irrotational inviscid incompressible flow; two-dimensional and three-dimensional potential flow.

AEM 6024. Fluid Dynamics. (3 cr. Prereq—4201 or equiv, Math 2263 or equiv) Mathematical and physical principles governing the motion of fluids. Kinematic, dynamic, and thermodynamic properties of fluids; stress and deformation; equations of motion; analysis of rotational and irrotational inviscid incompressible flow; two-dimensional and three-dimensional potential flow.

AEM 6201. Fluid Mechanics I. (3 cr. Prereq—8201 or equiv, Math 2263 or equiv) Fluid mechanics and basic fluid mechanics principles. Fluids and their behavior; properties of fluids; stress and deformation; equations of motion; analysis of rotational and irrotational inviscid incompressible flow; two-dimensional and three-dimensional potential flow.

AEM 8201. Fluid Mechanics I. (3 cr. Prereq—8201 or equiv, Math 2263 or equiv) Mathematical and physical principles governing the motion of fluids. Kinematic, dynamic, and thermodynamic properties of fluids; stress and deformation; equations of motion; analysis of rotational and irrotational inviscid incompressible flow; two-dimensional and three-dimensional potential flow.

AEM 8202. Fluid Mechanics II. (3 cr. Prereq—8201) Analysis of incompressible viscous flow; creeping flows; boundary layer flow.

AEM 8203. Fluid Mechanics III. (3 cr. Prereq—8201) Analysis of compressible flow and shock waves; method of characteristics for one-dimensional unsteady flow and for two-dimensional steady flow.


AEM 8211. Theory of Turbulence I. (3 cr. Prereq—8202) Reynolds equations, methods of averaging, elements of stability theory and vortex dynamics; description of large vortical structures in mixing layers and boundary layers; horseshoe vortices; flow visualization.

AEM 8212. Theory of Turbulence II. (3 cr. Prereq—8211) Prandtl’s mixing length theory applied to classical boundary layer, pipe, jet, and wake flows; prediction methods used at Stanford Conference; law of wall; law of wake; K-epsilon method.


AEM 8221. Rheological Fluid Mechanics. (3 cr. Prereq—8201 or 5501 or §) Methods of solution for flows of simple fluids with general constitutive equations. Topics from viscometric flow, extensional flow, perturbations of the rest state with steady and unsteady flow, secondary flow.

AEM 8241. Perturbation Methods in Fluid Mechanics. (3 cr. Prereq–8220 or #) Method of matched asymptotic expansions presented through simple examples and applied to viscous flows at high and low Reynolds numbers and other problems in fluid mechanics and applied mathematics.

AEM 8251. Finite-Volume Methods in Computational Fluid Dynamics. (3 cr. Prereq–8421 or 8201 or equiv, Csci 1107 or equiv) Development of finite-volume computational methods for solution of compressible Navier-Stokes equations. Accuracy, consistency, and stability of numerical methods; high-resolution upwind shock-capturing schemes; treatment of boundary conditions; explicit and implicit formulations; considerations for high performance computers; recent developments and advanced topics.


AEM 8261. Nonlinear Waves in Mechanics. (3 cr. Prereq–5501 or #) Theory of kinematic, hyperbolic, and dispersive waves, with applications to traffic flow, gas dynamics, and water waves.

AEM 8271. Experimental Methods in Fluid Mechanics. (3 cr. Prereq–4201, #) Overview of computer organization, including external communications and A/D, D/A conversion. Measurement techniques, such as pressure measurements and hot-wire and laser Doppler anemometry. Signal processing and uncertainty; computer control of experiments.

AEM 8295. Selected Topics in Fluid Mechanics. (1-4 cr. [max 8 cr. Prereq–#]) Includes individual student projects completed under guidance of a faculty sponsor.

AEM 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

AEM 8400. Seminar: Aerospace Systems. (1 cr. [max 4 cr]; S-N only. Prereq–Aerospace Eng grad student) Developing program of research in aerospace systems. Discussions of current research/topics of interest.

AEM 8401. Modern Feedback Control. (3 cr. Prereq–4311 or #) State space theory for multiple-input-multiple-output (MIMO) aerospace systems. Singular value decomposition (SVD) technique and its applications to performance and robustness. Linear quadratic gaussian (LQG) and eigenstructure assignment design to performance and robustness. Linear quadratic decomposition (SVD) technique and its applications or #)


AEM 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

AEM 8495. Advanced Topics in Aerospace Systems. (1-4 cr [max 8 cr. A-F only. Prereq–#] Individual student projects completed under guidance of a faculty sponsor.

AEM 8500. Research Seminar in Mechanics of Materials. (1-3 cr [max 12 cr]; A-F only. Prereq–#) Seminars given by students, faculty, and visitors on topics drawn from current research.

AEM 8511. Advanced Topics in Continuum Mechanics. (3 cr. [max 6 cr. A-F only. Prereq–5501 or #]) Constitutive equations; invariance and thermodynamic restrictions. Nonlinear elasticity theory; exact solutions, minimization, stability. Non-Newtonian fluids; viscometric flows, viscometric functions, normal stress. Other topics may include reactive and/or nonreactive mixtures, nonlinear plasticity, and deformable electromagnetic continua.

AEM 8521. Advanced Topics in Elasticity. (3 cr. A-F only. Prereq–5503) Contact stresses, finite deformations, and other topics.

AEM 8523. Elastodynamics. (3 cr. A-F only. Prereq–4531 or 5501 or #) Waves and vibrations in rods, beams, and plates; dispersion; volume and surface waves; reflection; energy theorems; vibrations of bounded media and relation to techniques; elements of nonlinear waves, inelastic waves, and stability of motion of elastic systems.

AEM 8531. Fracture Mechanics. (3 cr. A-F only. Prereq–5503 or #) Theories of mechanical breakdown. Kinetic rate theories and instability considerations; formation of equilibrium cracks and circular crack propagation under pulses; statistical aspects of strength and fracture of micromolecular systems; time and temperature dependency in fracture problems and instability of compressed material systems.

AEM 8533. Theory of Plasticity. (3 cr. Prereq–5203 or #) Theory of permanent deformation of ductile metals; bi-linear material models, Drucker’s three bar truss, and other examples. Formulation, yield surfaces, hardening rules, and material stability; slip line theory, Prandtl punch solution; single crystal plasticity.


AEM 8551. Multiscale Methods for Bridging Length and Time Scales. (3 cr. A-F only. Prereq–Basic knowledge of [continuum mechanics, atomic forces], familiarity with partial differential equations, grad student in [engineering or mathematics or physics]) Classical/numerical techniques for bridging length/time scales. Nonlinear elasticity, viscous fluids, and micromagnetics from macro/atomic viewpoints. Statistical mechanics, kinetic theory of gases, weak convergence methods, quasicontinuum, effective Hamiltonians, MD, new methods for bridging time scales.


AEM 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

AEM 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

AEM 8880. Plan B Project. (1-3 cr [max 3 cr. Prereq–Grad aerospace engineering or mechanics major, #] Satisfies project requirement for Plan B Master’s degree. May appear on M.S. program but does not count toward 20-credit maximum in the major field. Topic arranged by student and advisor; written report required.

AEM 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr. Prereq–Max 18 cr per semester or summer; 24 cr required)

Afro-American Studies (Afro) Department of African American and African Studies

College of Liberal Arts

Afro 5072. Racism: Social and Psychological Consequences for Black Americans. (3 cr) Racism and its effects on African Americans; definitions, determinants, and dynamics. Examined in an experiential context to reflect individual and institutional racism.


Afro 5181. Blacks in American Theatre. (3 cr. §Th 5181) Historical survey of significant events in the development of American black theater traditions. Essays, plays, playwrights, and theaters from early colonial references to the Black Arts Movement.
Afro 5182. Contemporary Black Theatre: 1960-Present. (3 cr.)§ Afro 5182
Essays, plays, playwrights, and theaters that have contributed significantly to contemporary black theater. From the beginning of the Black Arts movement to the present.

Afro 5191. Seminar: The African American Experience in South Africa. (3 cr.)§ Hist 5438
Ideological, political, religious, and cultural ties that have informed African American and black South African relations from late 18th century to present.


Afro 5401. Field Studies in African American and African Studies. (1-6 cr [max 6 cr]. Prereq–African American or African Studies major or minor, #) Supervised field study/internship focused on African American or African culture(s), language(s), and development.

Afro 5405. The African American Child. (3 cr. §Afro 3405) Research carried out by African American psychologists and behavioral/social scientists, and by experts on African American child/youth development.


Afro 5437. History of East Africa. (3 cr; A-F only. §Afro 3437, Hist 3437, Hist 5437) Major themes in history of East Africa, from era of early human cultural development to present. Methods that historians use to reconstruct history. Varying interpretations/constructions of history over time.

Afro 5478. Contemporary Politics in Africa and the Colonial Legacy. (4 cr; A-F only §Afro 4478, Pol 4478, Pol 5478. Prereq–Pol 1054 or Pol 3051 or non-pol sci grad student or #) How current politics in mainly, though not exclusively, sub-Saharan Africa have been shaped by pre-colonial/colonial processes. Reality of independence, recurrent political/economic crises. Global context, prospects for effective democracy.

Afro 5551. Methods: Use of Oral Traditions as Resources for History. (3 cr) Use of spoken information through time as a source for writing history. Use of canons of history to analyze and critique oral traditions and integrate them into written history.

Afro 5593. The African American Novel. (3 cr. §Engl 5593) Contextual readings of 19th- and 20th-century black novelists, including Chestus, Hurston, Wright, Baldwin, Petry, Morrison, and Reed.

Afro 5597. Seminar: Harlem Renaissance. (3 cr. §Engl 5597) A multidisciplinary review of the Jazz Age’s Harlem Renaissance: literature, popular culture, visual arts, political journalism, and major black and white figures.


Afro 5655. African American Cinema. (3 cr. §ArtH 5655) Exploration of African American cinematic achievements, from the silent films of Oscar Micheaux through contemporary Hollywood and independent films, using class screenings and critical readings.


Afro 5741. Minorities and Mass Media. (3 cr; A-F only. Prereq–journ major or minor, Jour 3014A) Analysis of relationships between mass media and communities of color in the United States. Focuses on issues of content and control.

Afro 5756. Social and Cultural History of Blacks in Sports. (3 cr §Eng 3756) Social/cultural contexts surrounding eras of athletes such as Jack Johnson, Jackie Robinson, Joe Louis, Jesse Owens, Althea Gibson, Wilma Rudolph, Muhammad Ali, Michael Jordan, and Tiger Woods. Impact of these athletes on national/international events. Periods when it was not uncommon for black entertainers/athletes to become involved in politics and community activism.

Afro 5864. Proseminar: African-American History. (3-4 cr. Prereq–#) Examination of issues including slavery, Reconstruction, the Great Depression, and civil rights movement using cultural and intellectual history and autobiography/biography. Focuses on dynamics of race, gender, class, region, sexuality, and religion.

Afro 5865. Proseminar: African-American History. (3-4 cr. §Afro 4865) Construction of a detailed research agenda, locating appropriate depositories of primary materials and secondary sources, and developing appropriate methodologies and frameworks.


Afro 5876. Proseminar: Approaches to African Development. (3 cr) Study, critical analysis, and comparison of primary documents relevant to African development.

Afro 5910. Topics in African American and African Studies. (1-3 cr [max 9 cr]) Topics specified in Class Schedule.

Afro 5993. Directed Study. (1-3 cr [max 3 cr. Prereq–#]) Guided individual reading/study for qualified seniors and graduate students.

Afro 8202. Seminar: Intellectual History of Race. (3 cr) Shifting and contested meanings of “race” from the “Age of Conquest” to the present. Starting from the proposition that race is not a fixed or stable category of social thought or being, the seminar seeks to ascertain how and why Western ideas about race have changed.

Afro 8554. Seminar: Gender, Race, Nation, and Policy—Perspectives from Within the African Diaspora. (3 cr. Prereq–#) Interdisciplinary analysis of U.S. domestic and foreign policies as they affect Africans and peoples of African descent in the diaspora. Intersections of gender, race, nation, and class.

Afro 8690. Figures in Contemporary Black Fiction. (3 cr [max 9 cr]) Each term focuses on works of an individual writer, such as Toni Morrison, Paule Marshall, and Jamaica Kincaid. Critical studies.

Afro 8802. Seminar: Orientalism. (3 cr) Recent arguments related to Orientalism as a trend in modern literary and cultural criticism.

Afro 8910. Topics in Studies of Africa and the African Diaspora. (3 cr [max 9 cr]) Topics specified in Class Schedule.

Agricultural, Food, and Environmental Education (AFEE)

Department of Work, Community, and Family Education

College of Education and Human Development

AFEE 5111. Agricultural Education: Methods of Teaching. (4 cr) Use of teaching resources; principles of teaching and learning; problem-solving techniques, lesson plan construction for large group, small group and individual investigations; student management; and assessment.

AFEE 5112. Agricultural Education Program Organization and Curriculum for Youth. (3 cr) Development of community school program in agriculture, agribusiness, and environmental science. Program to meet graduation outcomes and determine student needs.

AFEE 5113. Adult Agricultural Education Program Development and Technology. (3 cr; A-F only) Organization and implementation of education programs for farmers, farm managers, and agribusiness personnel using community and environmental resources, agricultural and instructional technology, and management information systems to attain family and business goals.

AFEE 5114. Agricultural Education Teaching Seminar. (1 cr) Reflective learning on teacher preparation experience; identify issues and problems facing the discipline; needs for continual preparation and program adjustment.


AFEE 5118. Strategies for Managing and Advising the FFA Organization. (2 cr; A-F only. Prereq–Agricultural education major or #) Principles/techniques to advise an FFA chapter. Historical/philosophical basis of FFA, organization/structure. Integration with classroom instruction, public relations, recruitment, and administration of FFA chapters.

AFEE 5220. Special Topics in Agriculture Education and Extension. (1-3 cr [max 12 cr]) Content varies by offering.

AFEE 5231. Agricultural Education Curriculum K-12. (2 cr; A-F only) Philosophy, organization, and administration of instruction in agricultural education programs at the elementary, middle, and high school levels.

AFEE 5233. Advanced Procedures in Teaching Agricultural Education. (2 cr; A-F only) New developments in methodology; assessment of innovations and procedures; consideration of various levels of instruction.

Courses

For definitions of course numbers, abbreviations, and symbols, see page 167.
Courses

AFEE 5235. Advanced Supervised Agricultural Experience Program. (2 cr)
The organization and administration of agricultural experience programs for middle and secondary level students: career exploration, development projects, experiments, placement in production/business/community settings, entrepreneurship, and current state and national programs and resource material.

AFEE 5237. Mentorship for Supervising Agricultural Education Teachers. (2 cr)
Professional development training for experienced teachers to serve as mentors for beginning and student teachers of agricultural education. Emphasis on supervision and assessment of teaching performance. Focus on critical period of induction into the teaching profession.

AFEE 5239. Program Organization and Management in Agricultural Education. (2 cr)
Analysis of organization, management, and assessment of agricultural education programs at the middle, high school, and adult levels.

AFEE 5280. Current Issues for the Beginning Agricultural Education Teacher. (1-3 cr [max 3 cr])
Reflection, analysis on current problems and issues confronting beginning teachers of agricultural education. Issues in teaching methods, classroom and program management, discipline, curriculum, EPA and SAE development, school-to-work relationships.

AFEE 5290. Seminar: Current Issues in Agricultural Education and Extension. (1-3 cr [max 6 cr])
Exploration of current issues in agricultural education and extension, strategies of response, implications of response actions, and related leadership roles.

AFEE 5296. Professional Experience Practicum in Agricultural Education and Extension. (1-4 cr [max 4 cr])
Observation, study, and experience in agricultural business and industry; identification of educational problems observed in the agricultural industry; evaluation of personal experience.

AFEE 5311. History, Philosophy, and Systems of Extension. (3 cr; A-F only)
History and philosophy of extension; modification and adaptation to worldwide methods and approved practices; extension methodologies; innovative approaches; systems appropriate to development environments.

AFEE 5341. Global Program Delivery Techniques and Technology of Extension. (2 cr; A-F only. 9WCFE 5341)
Educational activities, teaching, and communications methods and techniques, from outreach to extension services, with an emphasis on youth and adult education programs in different global settings.

AFEE 5351. Methods for Change in Developing Countries. (3 cr; A-F only 9WCFE 5351)
Strategies and methodologies promoting change in developing countries. Examination of sociological and cultural parameters of improved practices in rural, community, and agricultural development. Project planning, implementation, and evaluation related to change in developing countries.

AFEE 5361. World Development Problems. (3 cr; A-F only)
Introduction to development problems throughout the world. Development in Third World countries. Examples of First World development problems. Interdisciplinary focus on population, health and disease, education, agriculture, industry, finance, politics, and human rights.

AFEE 5371. Farming Systems Research and Extension. (3 cr; A-F only)
Introduction to the theory and practice of linking farming systems, research, and extension. An interdisciplinary and holistic approach to rural development for individuals and communities throughout the world.

AFEE 5405. Advanced Farm Financial Analysis Methodology and Concepts. (1 cr)
Farm financial analysis concepts, whole entity financial analysis issues/tools, enterprise analysis options/methodologies. Evaluation of industry standardization efforts. Analysis of where each option fits.

AFEE 5407. Application of Advanced Farm Financial Analysis Tools and Methods. (1 cr)
Use of advanced farm financial analysis tools/methodology to analyze financial performance of actual farm businesses. Case farms are used to apply whole entity financial analysis tools/concepts and enterprise analysis methodologies.

AFEE 5409. Seminar: Teaching Strategic Farm Business Planning. (1 cr [max 4 cr]; A-F only)
Teaching strategic business planning to farm managers and agricultural professionals. Philosophy of strategic management, components of a strategic business plan. Materials/tools to apply strategic farm business planning in educational programs. Students apply strategic planning methods/concepts to case farm businesses.

AFEE 5411. Seminar: Farm Financial Planning Teaching Tools and Methods. (1 cr [max 4 cr]; A-F only)
Preparation to teach farm financial planning to farm managers and agricultural professionals. Principles/concepts of long range financial planning and short range cash flow planning. Farm planning software tools, case farm situations, practical farm planning experience.

AFEE 5413. Seminar: Teaching Effective Use of Commodity Marketing Tools. (1 cr [max 4 cr]; A-F only)
Teaching commodity marketing tools to farm managers and agricultural professionals. Commodity marketing tools, including cash forward contracts, futures, and options, and how to use them to enhance price and protect income. How to choose marketing tools, given financial/market conditions.

AFEE 5415. Seminar: Teaching Commodity Marketing Strategies. (1 cr [max 4 cr]; A-F only)
Teaching commodity market planning to farm managers and agricultural professionals. Development of marketing plans to enhance price and protect income. Introduction to tools to simulate implementation of plans against actual price scenarios.

AFEE 5993. Directed Study in Agricultural Education and Extension. (1-5 cr [max 9 cr])
Topics may be chosen to permit study of areas within education or to supplement areas of inquiry not provided in the regular course structure.

AFEE 5995. Integrating Paper—Master of Education: Agricultural and Extension Education. (1-4 cr [max 4 cr]; A-F only)
Students prepare paper dealing with issues in agricultural education applied to professional responsibilities.

AFEE 8090. Seminar: Agricultural Education and Extension. (1-3 cr [max 6 cr]. Prereq—AgEd grad student)
Topics on various aspects of agricultural education. Prepare, present, and critique a report.

AFEE 8094. Research in Agricultural Education and Extension. (1-6 cr [max 6 cr]; A-F only. Prereq—AgEd student doing Plan B research, A)
Select problems, prepare bibliographies, analyze and interpret data, and prepare manuscripts on studies.

Agronomy and Plant Genomics (Agro)

College of Agricultural, Food, and Environmental Sciences

Agro 5021. Introduction to Plant Breeding. (3 cr. Prereq—GCB 3022 or equiv, background in plant science)
For majors not specializing in plant breeding. How genetics is applied to plant improvement. Emphasizes sustainable-production scenarios.

Agro 5121. Applied Experimental Design. (4 cr. §Ent 5121, Prereq—Stat 5201 or equiv or #)
Principles of sampling methodologies, experimental design, and statistical analyses. Methods/procedures in generating scientific hypotheses. Organizing, initiating, conducting, and analyzing scientific experiments using experimental designs and statistical procedures.

Agro 5311. Research Methods in Crop Improvement and Production. (1 cr; S-N only. Prereq—applied plant sciences grad)
Demonstrations and discussions of techniques in crop improvement and/or production research. Presentations integrate biotechnology with traditional breeding methods; production systems emphasize ecologically sound cropping systems.

Agro 5321. Ecology of Agricultural Systems. (3 cr; A-F only. §Ent 5321. Prereq—3xxx or above course in [Agro or AEdSc or Ent or Hort or PiPa or Soil] or #)
Ecological approach to problems in agricultural systems. Formal methodologies of systems inquiry are developed/applied.

Agro 5999. Special Topics: Workshop in Agronomy. (1-6 cr [max 6 cr]. Prereq—Jr or Sr or grad student)
Workshops on various topics in agronomy and plant genetics. Presenters/faculty may include guest lecturers/experts. Topics specified in Class Schedule.

Agro 8005. Supervised Classroom or Extension Teaching Experience. (2 cr; S-N only. §BAE 8005. Hort 8005, PiPa 8005, Soil 8005. Prereq—Grad SEng major, #)
Classroom or extension teaching experience in one of the following departments: Agronomy and Plant Genetics; Biosystems and Agricultural Engineering; Horticultural Science; Plant Pathology; or Soil, Water, and Climate. Participation in discussions about effective teaching to strengthen skills and develop personal teaching philosophy.

Agro 8201. Plant Breeding Principles I. (3 cr; A-F only. §Hort 8201. Prereq—Stat 5301 or equiv)
Principles and current methods involved in breeding agronomic and horticultural crops. Use of genotypic/environment data to increase genetic gain, population improvement, parent building, alternative selection strategies, breeding for special traits, and new approaches.

Agro 8202. Plant Breeding Principles II. (4 cr. Prereq—8201, Stat 5301, EEB 5033 or #)
Breeding principles and methods; population concepts, constructing source populations, and varietal development. Use of quantitative genetics in decision making in plant breeding, emphasizing covariance of relatives, genotype by environment interactions, stability analysis, statistical methods of analysis, selection theory and application.

Agro 8231. Cytogenetics. (4 cr. Prereq—GCB 5034 or #)
Genetic principles in relation to the eukaryotic chromosome. Molecular cytogenetics of chromosome structure, replication, pairing, and crossing over. Behavior of deficiencies, duplications, inversions, interchanges. Aneuploidy, autoploidy, allopolyploidy, and uses of cytogenetic stocks in molecular and classical genetics and plant breeding.
Courses

American Studies (AmSt)

Department of American Studies

AmSt 5010. Religion and American Culture. (3 cr; A-F only) Role of religion in shaping contemporary American cultural pluralism. Institutions and processes, intellectual frameworks, aesthetic and symbolic systems that form religious communities and contribute to religious conflicts in U.S. society and culture.


AmSt 5402. American Indians in the Cinema. (3 cr; A-F only) Representations of American Indians in film, historically/contemporarily. What such representations assert about Native experience and cultural viability. What they reflect about particular relationships of power.

AmSt 5920. Topics in American Studies. (1-4 cr [max 9 cr]) Topics specified in Class Schedule.

AmSt 8201. Historical Foundations of American Studies. (3 cr. Prereq.–Grad AmSt major) Exposition of American studies as a field of inquiry, including its history, major theoretical framework, and interdisciplinary methodologies.

AmSt 8202. Theoretical Foundations and Current Practice in American Studies. (3 cr. A-F only. Prereq.–Grad AmSt major or #) Analysis of central theoretical work in the field and survey of key methodologies.

AmSt 8239. Gender, Race, Class, Ethnicity, and Sexuality in the United States: Research Strategies. (5 cr; A-F only) Social, cultural, and artistic modes of self-expression. Intellectual analysis of people in the United States identified as female or male or as members of groups defined by race, ethnicity, class, or sexual orientation.

AmSt 8240. Gender, Race, Class, Ethnicity, and Sexuality in the United States: Topical Development. (3 cr [max 9 cr]; A-F only. Prereq.–4) Social, cultural, and artistic modes of self-expression and intellectual analysis of people in the United States identified as female or male and/or as members of group defined by race, ethnicity, class, or sexual orientation.

AmSt 8249. Popular Culture: Research Strategies. (3 cr; A-F only. Prereq.–4) Study of the popular arts in their political and social context. Focuses on issues of race, gender, class, and nationalism.

AmSt 8250. Popular Culture: Topical Development. (3 cr [max 9 cr]; A-F only. Prereq.–4) Study of the popular arts in their political and social context. Focuses on issues of race, gender, class, and nationalism.

AmSt 8259. Language, History, and Culture: Research Strategies. (3 cr. Prereq.–4) Interdisciplinary study of connections between literary expression and history, particularly as they articulate themes in American culture.

AmSt 8260. Literature, History, and Culture: Topical Development. (3 cr. Prereq.–4) Interdisciplinary study of connections between literary expression and history, particularly as they articulate themes in American culture.

American Sign Language (ASL)

Department of Educational Psychology

College of Education and Human Development

ASL 5642. Classroom Communication Through ASL. (1-2 cr [max 5 cr]; S-only. Prereq.–A-F; required in ASL-# required) American Sign Language (ASL) form/function, vocabulary production, grammatical features needed by professionals working with children, storytelling strategies, technical sign language for classroom teachers, and progresses in repeated segments.

For definitions of course numbers, abbreviations, and symbols, see page 167.
Courses

AmSt 8401. Practicum in American Studies. (3 cr; A-F only. Prereq—4)
Training in teaching undergraduate courses in American studies.
AmSt 8444. FTE: Doctoral. (1 cr. Prereq—Doctoral student, adviser and DGS consent)
AmSt 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)
AmSt 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])
AmSt 8801. Dissertation Seminar. (3 cr; S-N only. Prereq—AmSt doctoral student beginning dissertation work)
Conceptualizing the research problem for the dissertation and structuring the process of writing a chapter of it.
AmSt 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)
AmSt 8920. Topics in American Studies. (3 cr [max 9 cr]; A-F only)
Topics specified in Class Schedule.
AmSt 8970. Independent Study in American Studies. (1-9 cr [max 9 cr]. Prereq—A)
Independent study of interdisciplinary aspects of American civilization under guidance of faculty members of various departments.

Anesthesiology (Anes)
Department of Anesthesiology
Medical School
Anes 5587. Adv Clinical Physiology I for Nurse Anesthetists. (3 cr; A-F only)
Cellular mechanisms underlying systems physiology. Cellular physiology, physiology of excitable tissues, renal physiology, cardiovascular physiology, hemostasis.
Anes 5588. Advanced Clinical Physiology II for Nurse Anesthetists. (3 cr; A-F only. Prereq—Advanced Clinical Physiology I for Nurse Anesthetists)
Respiratory physiology, acid-base physiology, gastrointestinal physiology, metabolism, endocrinology, reproductive physiology, physiology of pregnancy/labor.
Anes 5666. Chemistry and Physics for Nurse Anesthetists. (3 cr; A-F only. Prereq—General chemistry or equivalence)
Chemical equilibrium, organic chemistry, physics of fluids/gases, anesthetic applications.
Anes 8269. Research in Anesthesia. (1 cr)

Animal Science (AnSc)
Department of Animal Science
College of Agricultural, Food and Environmental Sciences
AnSc 5099. Special Workshop in Animal Science. (1-6 cr [max 12 cr]; A-F only. Prereq—4)
Topics vary. See Class Schedule or department. Topics may use guest lectures/experts.
AnSc 5200. Statistical Genetics and Genomics. (4 cr. §CMB 5200. Prereq—Biology, general chemistry or equivalent. [BioI 4003 or equivalent])
Linkage analysis for mapping genes with codominance, dominance, imprinting inheritance modes, linkage/transmission disequilibrium. Radiata/hybrid mapping. Parentage testing. Testing/ estimation of candidate gene effects. Experimental designs, statistical analysis for mapping quantitative trait loci (QTL) with additive, dominance, and epistatic effects, and for gene expression studies using microarrays. QTL analysis of gene expression data for mapping transcriptional regulation factors.
AnSc 5237. Endocrine and Reproductive Physiology. (2 cr. Prereq—AnSc 5001, BioSci 3021)
AnSc 8111. Genetic Improvement of Animals. (3 cr. Prereq—4)
Application of population genetics to livestock breeding; selection index theory and practice; basis of relationships and covariances among relatives; and selection based on multiple sources of information.
AnSc 8121. Linear Model Methods. (3 cr. Prereq—Stat 5021)
Techniques and statistical tools for analysis of data. Matrix manipulation, least-squares procedures, correction for environmental factors, estimation of components of variance, and standard errors of estimates.
AnSc 8131. Molecular Biology Techniques. (3 cr. §CMB 8335, Prereq—BioSci 4332, BioI 4003)
Basic theory and current methodologies of molecular biology and recombinant DNA technology. Lab work includes DNA and RNA hybridization, gene transfer, and polymerase chain reaction techniques. Primarily for students with limited exposure to molecular biology.
AnSc 8134. Ethical Conduct of Animal Research. (2 cr; A-F only. §VE Med 8134. Prereq—Grad student or prof school student or 4)
Ethical considerations in use of animal subjects in agricultural, veterinary, and biomedical research. Federal, state, and University guidelines relating to proper conduct for acquisition/use of animals for laboratory, observational, epidemiological, and clinical research. Regulatory requirements, bases for what is deemed proper conduct. Societal impact on scientific investigations utilizing animal subjects.
AnSc 8194. Research in Animal Genetics. (1-3 cr [max 3 cr]. Prereq—4)
Research in quantitative genetics, cytogenetics, molecular genetics, and other areas related to animal breeding.
AnSc 8211. Animal Growth and Development. (3 cr. Prereq—4)
Whole body growth of animals, bone, and adipose tissue; structure, function, differentiation, and development of tissues; mode of action of hormones, growth factors, and growth promoters.
AnSc 8294. Research in Muscle Chemistry and Physiology. (1-3 cr [max 3 cr]. Prereq—4)
Research in selected areas.
AnSc 8311. Animal Biomechanics. (3 cr; A-F only. Prereq—BioSci 4331 recommended. 3)
Integrated systems approach to energy metabolism of animals. Application of classical techniques of calorimetry and comparative slaughter, development of systems for expressing energy content of feeds, and techniques for measuring whole body and organ metabolism of specific nutrients. Offered alternate years.
AnSc 8312. Protein Metabolism. (3 cr; A-F only. Prereq—BioSci 4331)
Basic and applied concepts of protein metabolism in farm animals.
AnSc 8320. Concepts and Developments in Nutritional Physiology. (3 cr [max 6 cr]. A-F only. Prereq—4)
Review and critical evaluation of pertinent scientific literature.
AnSc 8330. Concepts and Developments in Ruminant Nutrition. (1-2 cr [max 1 cr]. A-F only. Prereq—4)
Review and critical evaluation of recent research reports.
AnSc 8333. FTE: Master’s. (1 cr. Prereq—Master’s student, adviser and DGS consent)
Review and critical evaluation of scientific literature.
AnSc 8394. Research in Animal Nutrition. (1-3 cr [max 3 cr]. Prereq—4)
Research in selected areas: topics and animal species determined by consultation.
AnSc 8411. Physiology of Reproduction. (3 cr; A-F only. Prereq—3305 or 3527 or 3529)
Emphasis is on gametogenesis, conception, and implantation.
AnSc 8421. Physiology of Fertilization and Gestation. (3 cr. Prereq—3305 or #)
Physiological events occurring during gametogenesis; capacitation and fertilization; period of the embryo; period of the fetus; and parturition.
AnSc 8431. Immunoreproduction. (3 cr. Prereq—3305 or #)
Blood groups and polymorphic proteins affecting reproduction; immunoglobulin formation; antibodies of semen, ova, and genital secretions; immunopathology; maternal-fetal incompatibility; and antibodies to hormones.
AnSc 8444. FTE: Doctoral. (1 cr. Prereq—Doctoral student, adviser and DGS consent)
AnSc 8451. Reproductive Endocrinology. (2 cr; A-F only. Prereq—3305 or 3527 or BioSci 3021)
Hormonal regulation of mammalian reproductive cycles and seasonal patterns; perinatal and stress effects on reproductive endocrinology; mechanism of hormone action.
AnSc 8494. Research in Animal Physiology. (1-3 cr [max 3 cr]. Prereq—4)
Individual research under faculty direction. Topic determined by consultation: a specialized aspect of a thesis problem or an independent problem of mutual interest to graduate student and adviser.
AnSc 8510. Graduate Seminar. (1-2 cr [max 12 cr]; S-N only. Prereq—4)
Student presentations of literature, proposals, and research results; instructional guidelines and performance evaluation; preparation of visual material.
AnSc 8594. Research in Animal Science. (1-3 cr [max 3 cr]. Prereq—4)
Research including experimental studies in disciplines associated with animal production and research, with emphasis on interdisciplinary studies.
AnSc 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)
AnSc 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])
AnSc 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

Anthropology (Anth)
Department of Anthropology
College of Liberal Arts
Anth 5008. Advanced Flintknapping. (3 cr; A-F only. Prereq—3008 or 5269 or 4)
Hands-on training in techniques of advanced stone tool production, artifact reproduction, and lithic experimental design for academic/artistic purposes.
Anth 5025. Cultural Semantics. (3 cr)
Understanding cultures and cognitive classification systems through lexical semantics.
Anth 5027. Origins of European Civilization. (3 cr. §Anth 3027)
Early development of European culture, from Old Stone Age to Roman period. Principle transformations of European culture with introduction of agriculture, development of metallurgy and trade, and emergence of towns and cities.
Anth 5029. Philosophical Anthropology. (3 cr; A-F only. Prereq—Sr or grad student or #) Advanced survey of traditional problems associated with broad-ranging views on human nature and culture. Specific arguments of relativists, behaviorists, phenomenologists, and others in relation to social life. Structuralist and post-structuralist approaches.

Anth 5031. Science as Cultural Practice. (3 cr. Prereq—Sr or grad student or #) Ethnographic, historical and sociological accounts of scientific practice. How facts are constructed/negotiated. Social, cultural, and political influences on scientific methods. How scientific projects articulate with hierarchies of race/gender. International differences in scientific practice.

Anth 5033. Feminist Anthropology. (3 cr. Prereq—3047 or grad or #) Advanced introduction to the development of feminist theory in anthropology. Theoretical and methodological shifts in feminist anthropology and ethography. Feminist ethnography within the discipline as a whole; current debates concerning the reading and writing of ethnography.

Anth 5041. Ecological Anthropology. (3 cr. §Anth 3041, Anth 8213. Prereq—Grad or #) Concepts, theories, and methods of ecological anthropology (cultural ecology) show how humans interact with the biophysical environment. Compare biological and cultural interactions with the environment; examine adaptive strategies cross-culturally.

Anth 5043. Colonialism and Culture. (3 cr; A-F only. §Anth 5643) Making of culture as colonial/anthropological object of knowledge. Relationship between colonial knowledge/formation of academic disciplines (especially anthropology). Colonial/postcolonial transformations of colony, nation, and metropole.

Anth 5045. Urban Anthropology. (3 cr. Prereq—4003 or grad or #) Anthropological approaches to urban life in Western and non-Western settings. Topics include social networks and voluntary organizations; class, ethnicity, gender and power; migration and immigration; urban labor and economics; and urban “problems.”

Anth 5221. Anthropology of Material Culture. (3 cr. A-F only. §Anth 3221) Material culture as a social creation, studied from multiple perspectives (e.g., social anthropology, archaeology, primatology). Conceptions of how humans articulate with material world they construct.


Anth 5269. Analysis of Stone Tool Technology. (4 cr; A-F only. Prereq—1001 or 3001 or #) Practical lab experience. How to analyze archaeological collections of stone tools to learn about human technological behavior in past. Students analyze archaeological/experimental collections, make stone tools themselves.

Anth 5980. Topics in Anthropology: History of Anthropology. (3 cr [max 6 cr].) Topics specified in Class Schedule.

Anth 5990. Topics in Archaeology. (3 cr [max 9 cr]; A-F only. Prereq—#) Topics specified in Class Schedule.

Anth 8001. Foundations of Social and Cultural Anthropology. (3 cr; A-F only. Prereq—Grad antm major or #) Introductory concepts, methods, and ethnographic work in the field. Emphasis on theories that have shaped 20th-century thinking in cultural anthropology; explores connection of these theories to fieldwork and contemporary issues.

Anth 8002. Foundations of Social and Cultural Anthropology. (5 cr; A-F only. Prereq—8001) Further introduction to important concepts and perspectives in anthropology, with emphasis on past and contemporary American cultural anthropology. Includes treatment in semiotic, psychological, and feminist anthropology.

Anth 8004. Foundations of Anthropological Archaeology. (3 cr. Prereq—8001, 8002) Theoretical foundations of anthropological archaeology in historical and contemporary perspective.

Anth 8120. Problems in Culture Change and Applied Anthropology. (3-6 cr [max 6 cr]) Comparative studies of change in cultural systems. Impact of global processes on local cultures. Roles of anthropology and anthropologists in policy, planning, implementation, and evaluation.

Anth 8203. Research Methods in Social and Cultural Anthropology. (3 cr. Prereq—Grad antm major or #) Classic and current issues in research methodology, including positivist, interpretivist, feminist, and postmodernist frameworks. Methodology in the broadest sense of the concept, is evaluated. Students conduct three research exercises and set up an ethnographic research project.

Anth 8205. Economic Anthropology. (3 cr. §Anth 4053) Theoretical foundations of economic anthropology examined through critical readings of traditional, classical, and contemporary authors. Ethnographic puzzles of material life and issues of ecological degradation, development, market expansion, gender, and transglobal processes.

Anth 8207. Political and Social Anthropology. (3 cr) Western concepts of politics, power, authority, society, state, and law. Cross-cultural approaches to these concepts in historical perspective. Major theoretical frameworks and current problems and positions in social and political anthropology. Ethnographic classics and new directions.

Anth 8209. Psychological Anthropology. (3 cr. §Anth 4021) Self, emotion, cognitive processes, and child development in cross-cultural perspective.

Anth 8211. Symbolic Anthropology. (3 cr. §Anth 4019) Advanced introduction to semiotic, structuralist, and interpretive approaches in anthropology. Reviews classic foundations and recent developments.

Anth 8213. Ecological Anthropology. (3 cr. §Anth 3041, Anth 5041) Seminar on method, theory, and key problems in ecological anthropology and human ecology. Examines approaches in light of human practices, interactions between culture and the environment, global environmental change, and our understanding of human dimensions of ecosystem-based management.

Anth 8215. Anthropology of Gender. (3 cr. Prereq—Grad antm major or #) Comparative, cross-cultural approach to gender. Focuses on various theories (e.g., feminist, postmodernist, psychoanalytic) of power, gender, authority, and femininity and masculinity. Gender ambiguity and issues of sexuality.

Anth 8219. Grant Writing. (2 cr. Prereq—Grad antm majors preparing to submit research grant proposals next academic yr.) Students draft a research proposal in their area of interest. Seminar involves reading and evaluating proposals, learning about funding and process of submitting proposals, nuts of bolts of composing a proposal, and ethics of research in anthropology.


Anth 8230. Development and Management of Anthropological Research Projects. (1 cr [max 4 cr]; A-F only. Prereq—Anth grad student or #) Training seminar on research development, coordination, grant management, field/labatory research management, and fundraising.


Anth 8333. FTE: Masters. (1 cr. Prereq—Master’s student, adviser and DGS consent)

Anth 8444. FTE: Doctoral. (1 cr. Prereq—Doctoral student, adviser and DGS consent)

Anth 8510. Topics in Archaeology. (3-9 cr [max 9 cr]) Seminar examines particular aspects of archaeological methods and/or theory. Topics vary according to student and faculty interests.

Anth 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Anth 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 or total required [Plan A only])

Anth 8810. Topics in Sociocultural Anthropology. (3-9 cr [max 9 cr]) Seminar examines particular aspects of method and/or theory. Topics vary according to student and faculty interests.

Anth 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

Anth 8991. Independent Study. (1-18 cr [max 18 cr]. Prereq—#) Under special circumstances and with instructor approval, qualified students may register for a listed course on a tutorial basis.

Anth 8992. Directed Reading. (1-18 cr [max 18 cr]. Prereq—#)

Anth 8993. Directed Study. (1-18 cr [max 18 cr]. Prereq—#)

Anth 8994. Directed Research. (1-18 cr [max 18 cr]. Prereq—#)

Applied Economics (ApEc)
Department of Applied Economics

College of Agricultural, Food and Environmental Sciences


ApEc 5032. Economic Data Analysis for Managerial and Policy Decisions. (3 cr. Prereq—[5031 or #; familiarity with basic statistics]

Statistical/econometric methods for the analysis of large data sets to support managerial/policy decisions. Methods for organizing, accessing, and ensuring the quality of data. Estimation techniques include panel data methods, limited dependent variable models, and time series analysis. Emphasizes clarity of reporting and design of procedures for maintaining/updating data estimates.

For definitions of course numbers, abbreviations, and symbols, see page 167.
Courses

ApEc 5151. Applied Microeconomics: Firm and Household. (3 cr.; Prereq.–3001 or Math 1271 or Math 2243 or equiv or grad student or #) Quantitative techniques for analysis of economic problems of firms and households. Links between quantitative policy and economic analysis. Regression analysis, mathematical programming, and present value analysis.

ApEc 5152. Applied Macroeconomics: Income and Employment. (3 cr. Prereq.–3001 or Math 1271 or Math 2243 or equiv or grad student or #) Static general equilibrium open economy models and simple business cycle models that examine economic growth, business cycles, and fiscal and monetary policy. Input-output analysis and large scale economic models. Sector-specific analysis, economy and sector-wide data. Empirical applications.

ApEc 5321. Regional Economic Analysis. (3 cr. Prereq.–3006 or Econ 3102 or #) Regional development patterns and role of resources, transportation, and institutional constraints. Trade, migration, and investments in regional growth and change. Regional economic information in investment and location decisions. Evaluation of economic development policies and tools. Economic impact analysis.

ApEc 5341. Public Finance. (3 cr.; A-F only. Prereq.–3001 or Econ 3101 or PA 5021) Which services should the public sector provide? What level of government should provide them? How should governments fund those services? Which types of taxes should be levied and on whom? Applying economic theory/analysis to spending, revenue, and tax policy issues facing governments.


ApEc 5511. Labor Economics. (3 cr. Prereq.–3001 or Econ 3101 or #) Theoretical foundations of labor markets. Intertemporal/household labor supply. Demand for labor, efficiency wages. Human capital theory, unemployment, migration decisions. Analysis of econometric research applied to labor policy issues such as minimum wage, tax policy, social insurance, education.

ApEc 5581. Human Capital and Household Economics. (3 cr. Prereq.–3001 or Econ 3101 or #) Household economics and investment in human capital (e.g., children, education, health and nutrition); labor force participation, lifetime earnings, and nonmarket work; time allocation and substitution of capital for labor in the household in the western and third world.

ApEc 5611. Economic Aspects of Environmental Management. (3 cr; A-F only. Prereq.–[or grad student] in [biological science or conservation biology or ecology or fisheries or forestry or public affairs or water resources or wildlife conservation] or CLA or #) Economist approach to environmental problems such as water/air pollution. Application of supply/demand concepts to evaluation of environmental resources. Methods of evaluation. Analysis of pollution control policies from economic point of view.

ApEc 5651. Economics of Natural Resource and Environmental Management. (3 cr. Prereq.–[3001 or Econ 3101, 4611 or Econ 3611 or NRES 3261W] or #) Economic analyses, including project evaluation of current natural resource/environmental issues. Emphasis on intertemporal use of natural resources, natural resource scarcity/adequacy, environmental quality, and mechanisms for pollution control and their implications for public policy.

ApEc 5711. U.S. Agricultural and Environmental Policy. (3 cr. Prereq.–3001 or Econ 3101) U.S. agricultural/natural resource policies in an open world economy; role of private markets and government in regulating supply and demand; income vs. price support, supply controls, environmental constraints, and export promotionism; functioning of markets; roles of public interest groups and future of American agricultural policy.


ApEc 5811. Cooperative Organization. (3 cr. Prereq.–3001 or Econ 3101 or PA 5021 or #) Application of economic analysis to cooperative form of organization. Producer/consumer cooperatives used to examine economic issues such as changing market organization, financing, management incentives, taxation, and antitrust regulations. Cooperatives as a tool for economic development.

ApEc 5891. Independent Study: Advanced Topics in Farm and Agribusiness Management. (1-4 cr; max 4 cr. Prereq.–#) Special topics or individual work suited to the needs of particular groups of students.

ApEc 5991. Special Topics and Independent Study in Applied Economics. (1-4 cr; max 12 cr. Prereq.–#) Special classes, independent study, and supervised reading and research on subjects and problems not covered in regular courses.

ApEc 6020. Mathematical Optimization in Applied Economics. (3 cr. Prereq.–[5151, Econ 5151] or #) Economic foundations and applications of mathematical and dynamic programming and optimal control. Mathematical optimization concepts; structures and economic interpretations of various models of the firm, consumer, household, sector, and economy. Model building and solution techniques.


ApEc 6204. Applied Financial Economics. (3 cr; A-F only. Prereq.–Econ 5151 or [Econ 8001, Econ 8002] or #) Introduction to major theories of asset pricing under competitive markets, symmetric information. Equilibrium/arbitrage models of financial markets, option pricing models. Applications of asset pricing theories; agricultural markets, financial derivatives, interest rates, agricultural credit.

ApEc 6205. Applied Game Theory. (3 cr; A-F only. Prereq.–[Econ 8001, 8012, 8103, 8104] or [Econ 8001, Econ 8002, Econ 8003, 8004] or #) Topics in game theory, application to economic problems. For each topic, important theory/equilibrium concepts are followed by extensive applications. Focuses on static/dynamic games of complete/incomplete information, evolutionary games.

ApEc 8211. Econometric Analysis I (4 cr. Prereq.–[Stat 4102 or Stat 5102], Ph.D. student or #) Classical multiple linear regression, stochastic regressors, heteroscedasticity, autocorrelated disturbances, panel data, discrete dependent variables.

ApEc 8212. Econometric Analysis II. (4 cr. Prereq.–Econ 8211 or equiv or #) Second semester of econometrics for Ph.D. students. Specification tests, instrument variables, heteroscedasticity, panel data, simultaneous equations, bootstrap methods, limited dependent variable models, semiparametric estimation, econometrics of program evaluation, general method of moments, time series, hazard models.

ApEc 8333, FTE: Master's. (1 cr. Prereq.–Master's student, adviser and DGS consent)

ApEc 8401. Consumer Behavior and Policy. (2 cr; A-F only. Prereq.–Econ 5151 or [Econ 8001, Econ 8002] or [Econ 8101, Econ 8102] or #) Analytical/empirical treatments of consumer behavior. Household decision making. Demand for quality characteristics. Review of basic consumer theory, policy-related issues, experimental economics, consumer-survey techniques. Types of data available to analyze consumer behavior and household decisions.

ApEc 8402. Information and Behavioral Economics. (2 cr; A-F only. Prereq.–[Econ 8001, Econ 8002] or [Econ 8101, Econ 8102] or equiv or #) New theories of consumer behavior that combine economic and psychological models. Influence of information on consumer choice over time and under uncertainty. Expected, unexpected utility theory, information economics, bounded rationality, prospect theory, choice over time, and rational addiction with applications to empirical work.

ApEc 8403. Demand Analysis and Household Economics. (2 cr; A-F only. Prereq.–[Econ 8211, 8212, Econ 5151 or [Econ 8001, Econ 8002] or [Econ 8101, Econ 8102] or #) Household/individual behavior. Consumer demand analysis, education, and other issues. Static demand theory/estimation, dynamic demand theory/estimation, equivalence scales, intrahousehold allocation of consumption, analysis of education issues.


ApEc 8444. FTE: Doctoral. (1 cr. Prereq.–Doctoral student, adviser and DGS consent)


ApEc 8602. Economics of the Environment. (3 cr. Prereq.–Econ 8004 or Econ 8104 or #) Economic analysis of environmental management, emphasizing environmental policy. Application of microeconomic theory to problems of market failure, market-based pollution control policies, contingent valuation, hedonic models, option value, and other topics.
Courses


Arab 5503. Arabic Drama in Translation. (3 cr) Emergence and development of drama as a European-inspired genre in Arabic literature. Emphasizes major trends and playwrights. All readings in English.

Arab 5505. Survey of the Middle East. (3 cr) §Arab 3505, Hist 3509, MELC 3509) Peoples, lands, and cultures of the Middle East. Historical survey from earliest civilizations to the present.


Arab 5542. Medieval Islam. (3 cr §Arab 3542, Hist 3542, MELC 3542) Islamic dynasties, Mamluks and Mongols, and Crusaders and Assassins. Abbasid Caliphate’s disintegration and rise of Seljuk Turks.

Arab 5543. Arabs Under Mamluks and Ottomans: 1300-1920. (3 cr §Arab 3543, Hist 3543, MELC 3543) Struggle against Crusaders and Mongols. Disintegration and reemergence under Muhammad Ali of Egypt; dynastic struggles in Syria; rise of Young Turks; Arab revolt.

Arab 5544. Arab World 1920 to the Present. (3 cr §Arab 3544, Hist 3544, MELC 3544) Struggle in the Arab world for independence and its course since independence. Emphasis on development, political stability and unity; political structures; the Arab-Israeli conflict.


Arab 5900. Topics in Arabic Literature and Culture. (3 cr §Arab 5900, Hist 5900, MELC 5900) Readings and discussion of selected works in Arabic. Topics specified in Class Schedule.

Arab 5982. Directed Readings. (1-3 cr §Arab 5982, Hist 5982, MELC 5982) Individual research and readings for advanced students.

Arab 8333. FTE: Master’s. (1 cr §Arab 8333, Hist 8333, MELC 8333) Individual research and readings for advanced students.
Architecture (Arch)

Department of Architecture

College of Architecture and Landscape Architecture

Arch 5123. Architectural Thesis. (8 cr; A-F only. Prereq–5122, 5241. BA Arch major; students must submit thesis plan in semester before writing thesis) Student’s choice, study and solution of an architectural problem to demonstrate proficiency in all phases of design.

Arch 5241. Principles of Design Programming. (3 cr; A-F only. Prereq–For undergrads 5122, BA Arch major; for grads 8253, M Arch major or #) Concepts and techniques of architectural programming, including space and activity analysis, site selection, precedent study, code review, appropriate technology identification, hypothesis formation, and evaluation. Emphasis on conceptual development, research, and analytic drawing.

Arch 5282. Undergraduate Architecture Studio II. (6 cr; A-F only. Prereq–college or A. Exploration of human response to the natural forces of gravity, light, and air and their influence on the organization of material form to create places of human habitation.

Arch 5291. Accelerated Undergraduate Architecture Studio I. (6 cr; A-F only. Prereq–#) Selected architectural problems developed by faculty to deepen/emphasize ideas introduced in required architectural studio sequence.

Arch 5292. Accelerated Undergraduate Architecture Studio II. (6 cr; A-F only. Prereq–[5291, accelerated status] or #) Selected architectural problems developed by faculty to deepen/emphasize ideas introduced in required architectural studio sequence.

Arch 5350. Topics in Architectural Representation. (1-3 cr [max 3 cr]; A-F only. Prereq–[5321, [Arch major or M. Arch major]] or #) Selected topics in architectural representation.

Arch 5352. AutoCAD II. (3 cr. §LA 5352. Prereq–For undergrads 5351. BA Arch major or M Arch major; may not be taken for graduate credit) Intermediate concepts, tools, and techniques of computer-aided drawing with current AutoCAD Release. Strategies and techniques for producing dimensioned and annotated drawing suitable for plotting. Use of dimension variables, attributes, blocks, symbols, and the creation of customized menus.

Arch 5361. Topics in Architectural Representation: 3-D Architectural Modeling and Design. (3 cr; A-F only. Prereq–For undergrads 5281 or 5351. BA Arch major; for grads M Arch major or #) Introduction to 3-D studio for architectural modeling, rendering, and animation. Video recording and editing.

Arch 5371. Computer Methods I. (1 cr; S-N only. §LA 5371. Prereq–[5251, M Arch major or #) Introduction to current techniques, computer programs, and their application to architectural computing.

Arch 5372. Computer Methods II. (1 cr; S-N only. §LA 5372. Prereq–5371, §5252 and M Arch major or #) Current techniques, computer programs, and their application to architectural computing and design.

Arch 5373. Computer Methods III. (1 cr; S-N only. §LA 5373. Prereq–5372, §5253. M Arch major or #) Advanced techniques, computer programs, and their application to architectural computing in design, theory, and technology.

Arch 5374. Computer Methods IV. (1 cr. Prereq–5373. §5254, M Arch major or #) Advanced architectural computing applications in design, history, theory, representation, and technology.

Arch 5572. Architectural Structures II: Concrete and Masonry Design. (3 cr; A-F only. Prereq—5571, M Arch major or #) Overview of advanced materials: reinforced fiberglass, glass structural, and glass structural fabrics. Impact of construction technology on architecture and methods of integrating knowledge of structural materials and construction methods into the design process.

Arch 5611. Design in the Digital Age. (3 cr; A-F only. §Arch 3611. Prereq—Grad student or upper level undergrad student) Introduction to design, design process. Developing/ understanding ways of seeing, thinking, and acting as a designer. Changes in design being wrought by digital technology. Team design project.

Arch 5621. Professional Practice in Architecture. (3 cr; A-F only. Prereq—M Arch major or #) Legal, ethical, business, and practical requirements of architectural practice. Contemporary and historical models of contract formation, business principles, accounting, project management, design services, and marketing.

Arch 5631. Legal Contracts in Architecture. (3 cr; A-F only. Prereq—M Arch major or #) Legal subject matter relevant to the work of architects and design professionals.

Arch 5645. Real Estate Development in Architecture. (3 cr. Prereq—For undergrads BA Arch major; for grad M Arch major or #) Fundamentals of real estate development and investment building. Processes and rules of specialists in development of investment projects. Topics include pro forma value and depreciation, tax shelter, feasibility, market analysis, appraisal equity financing, design, construction, leasing, and property management.

Arch 5650. Topics in Architectural Practice. (1-4 cr [max 8 cr]. Prereq—Arch major or 5621, M Arch major or #) Topics in architectural practice, methods of design production, marketing, operation, and relationships among clients, architecture, and society.

Arch 5670. Topics in Historic Preservation. (1-3 cr [max 3 cr]. Prereq—Arch or M Arch major or #) Selected topics in the theory, philosophies, research, and methods of architectural historic preservation.

Arch 5671. Historic Preservation. (3 cr. Prereq—3412 or #) Philosophy, theory, and origins of historic preservation. Historic archaeology and research, descriptive analysis, and documentation of historic buildings. Government’s role in historic preservation, preservation standards and guidelines, preservation and building codes, neighborhood preservation, preservation advocacy, and future directions for historic preservation. Research on architectural and historical aspects of historic sites using primary and secondary resources and on controversial aspects of preservation.


Arch 5673. Historic Building Research and Documentation. (3 cr. Prereq—5672, 5672 cr or #) Philosophy, theory, and methods of historic building research, descriptive analysis of buildings, building documentation, historical archaeology, and architectural taxonomy.

Arch 5711. Design Principles of the Urban Landscape. (3 cr; A-F only. Prereq—BE or M Arch major or LA grad major or #) Art/design of creating city, neighborhood, and development plans. Public policies, planning tools/processes, and physical models used by design professionals and private/civic institutions to shape physical environment.

Arch 5721. Prosemnisar in Metropolitan Design. (3 cr; A-F only. §LA 5721. Prereq—[5711 or equiv], enrollment in CMD prog or #) Reading seminar. Evolution of the contemporary city. Dynamics that created contemporary urban spatial patterns. Planning/design theories that have guided public interventions in the built environment. Thematic texts, classroom discussions.

Arch 5750. Topics in Urban Design. (1-4 cr [max 4 cr; A-F only. Prereq—Arch—M Arch major) Special topics in theory/practice of urban design.

Arch 5790. Special Topics in Metropolitan Design. (3 cr [max 6 cr]; A-F only. §LA 5790. Prereq—Enrollment in CMD prog or #) Arch 5993. Directed Study. (1-4 cr [max 3 cr]; A-F only. Prereq—#) Guided individual reading or study.

Arch 8101. Subjects and Methods in Architecture. (2 cr; S-N only, Prereq—Grad Arch major or #) The discipline of architecture.

Arch 8250. Advanced Topics in Design. (1-6 cr [max 6 cr]; S-N only. Prereq—Admitted to 3+ track for MArch prog or #) Design studio.

Arch 8251. Graduate Architectural Design I. (8 cr; A-F only. Prereq—Grad Arch major or #) Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

Arch 8252. Graduate Architectural Design II. (6 cr; A-F only. Prereq—8251, grad Arch major or #) Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

Arch 8253. Graduate Architectural Design II. (6 cr; A-F only. Prereq—8252, grad arch major or #) Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

Arch 8254. Graduate Architectural Design IV. (6 cr; A-F only. Prereq—8253, grad Arch major or #) Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

Arch 8255. Graduate Architectural Design III. (6 cr [max 8 cr]; A-F only. Prereq—8254, grad Arch major or #) Fundamental architectural problems involving design as a creative inquiry. Individual and collaborative effort.

Arch 8256. Directed Graduate Architectural Design. (6 cr; A-F only. Prereq—8251, grad Arch major or #) Arch 8333. FTE: Master’s. (1 cr. Prereq—Master’s student, adviser and DGS consent)

Arch 8350. Advanced Topics in Representation. (1-3 cr [max 3 cr]; A-F only. Prereq—8311, grad Arch major or #) Theory and practice of visual representation in architecture.

Arch 8450. Topics in Theory. (1-3 cr [max 3 cr]; A-F only. Prereq—5411, grad Arch major or #) Arch 8494. Directed Research in Architectural History. (1-3 cr [max 3 cr]; A-F only. Prereq—Grad Arch major or #) Arch 8550. Topics in Technology. (1-3 cr [max 3 cr]; A-F only. Prereq—Grad arch major or #) Special topics in theory/practice of architecture technologies.

Arch 8650. Topics in Architectural Practice. (1-3 cr [max 3 cr]; A-F only. Prereq—Grad Arch major or #) Arch 8750. Topics in Urban Design. (1-3 cr [max 3 cr]; A-F only. Prereq—Grad Arch major or #) Arch 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Art (ArtS)

Department of Art

College of Liberal Arts

ArtS 5104. The Nature of Abstraction. (4 cr. Prereq—3102 or #) Exploration of abstraction as concept. Studio practice with attention to developing individual work. Emphasizes understanding topics relevant to abstraction. Approached from discipline of painting, open to various material sensibilities.

ArtS 5105. Advanced Dimensional Painting. (4 cr. Prereq—3105 or #) Illusionary space applied to sculptural forms. Practical applications of spatial/painterly concepts. Emphasizes critical/visual judgment. Development of cohesive body of work reflecting interaction of two/three dimensions.

ArtS 5106. Advanced Drawing: Interpreting the Site. (4 cr. Prereq—3106 or #) Search for personal content as inspired by site. Field trips (2/3 of course) to draw or paint from various metropolitan area locations. Interpretations enhanced by experimentation with new marks/symbols.


ArtS 5120. Advanced Painting. (4 cr [max 12 cr]). Prereq—3102 or #) Developing personal vision/content through painting. Emphasizes critical thinking, self-evaluation, and independent pursuit of ideas.


ArtS 5320. Advanced Sculpture: Spatial Problems. (4 cr [max 12 cr]. Prereq—3302 or #) Development of personal sculpture imagery. Sculptural practice outside traditional media/approaches. Installation, theater, public art, architecture as topics for individual investigations into spatial organization.

ArtS 5330. Advanced Sculpture: Metal Casting. (4 cr [max 12 cr. Prereq—3305 or #]) Metal casting of sculpture in bronze, iron, aluminum, other metals. Studio practice, investigation of historical/contemporary methods/concepts. Development of personal sculptural imagery.

Courses


Arts 5360. Advanced Performance Art and Installation. (4 cr [max 12 cr]. Prereq—3306 or #) Studio practice in performance art and installation; investigation of historical and contemporary methods and concepts of interdisciplinary expression. Development of personal imagery.


Arts 5403. Women’s Images and Images of Women. (3 cr. Prereq—4030. Prereq—1001 or #) Women’s place in Western art from the artist’s perspective. Women as artists and the imagery they have created. Women as the object of imagery and the social and political attitudes those images convey. Survey of women artists from late-Renaissance through contemporary feminism; relevant issues.


Arts 5441. Professional Practices. (3 cr. Prereq—Grad or #) Intensive writing seminar provides a context for theoretical issues, business practices, and professional skills required for career management and development in the visual arts.

Arts 5444. Bachelor of Fine Arts Exhibition. (1 cr; S–N only. Prereq—BFA candidate, or #) Final solo or small group exhibition and artist’s statement developed in consultation with faculty adviser. Visual documentation of work and statement as appropriate to media.

Arts 5490. Workshop in Art. (1–4 cr [max 12 cr]) Selected topics and intensive studio activity. Topics vary yearly.


Arts 5550. Advanced Papermaking. (4 cr [max 12 cr]. Prereq—3505 or #) Distinct expressive qualities of handmade paper, its versatility as contemporary art form. Independent research pursued in consultation with instructor.


Arts 5562. Time Arts: Advanced Video. (4 cr [max 12 cr]. Prereq—3602) Individual projects exploring elements of time, cinematic space, narrative, and montage through experimental, documentary, or installation-based video art. Articulation of relationships between conceptual, aesthetic, and artistic process.

Arts 5563. Time Arts: Advanced 2-D Animation. (4 cr [max 12 cr]. Prereq—3603 or #) Individual projects and further development of a personal voice and critical thinking in time-based art. Creating digital 2-D animation with emphasis on vector and layer-based raster animation techniques. Composing 2-D animation with video.

Arts 5564. Time Arts: Advanced: 3-D Animation. (4 cr [max 12 cr]. Prereq—3604 or #) Advanced exploration of modeled objects in modeled space and time. Compositing of animated images with video images. Individual projects, expansion of personal voice and visual clarity within the framework of 3-D imagery and time-based artwork.

Arts 5710. Advanced Photography. (4 cr [max 12 cr].) Prereq—Two semesters of 3xxx photography or #) Design/implement of individual advanced projects. Demonstrations, lectures, critique. Reading, writing, discussion of related articles/exhibitions.


Arts 5821. Ceramic Materials Analysis. (4 cr. Prereq—3801 or 3802 or #) Ceramic materials, their interrelationships. Advanced investigation of glazes, slip formulation, clay bodies in high/low temperature ranges. Individual interests related to students’ aesthetic needs.


Arts 5990. Independent Study in Art. (1–4 cr [max 12 cr]. Prereq–major, #) Independent study project designed by student in consultation with instructor.


Arts 6300. Sculpture: Theory and Analysis. (3 cr [max 6 cr]) Theoretical issues of sculpture as understood by practicing sculptors. Research on and discussion of current sculpture in light of historical precedent; personal work relative to contemporary practice.

Arts 8333. FTE: Master’s. (1 cr. Prereq—Master’s student, adviser and DGS consent)


Arts 8401. Studio and Pedagogy: Philosophy and Practice. (3 cr [max 6 cr]) Orientation to establishing studio practice, introduction of department and community resources, and preparation for teaching. Studio visits and critiques; development of artistic form and content using interactive digital technologies.

Arts 8410. Studio Critique. (3 cr [max 6 cr]; A-F only. Prereq—8400) Studio based critique to foster critical dialogue about art practice across media/disciplines. Colloquium for ideas/theories that migrate between artistic practices and influence studio work.

Arts 8550. Printmaking: Theory and Practice. (3 cr [max 12 cr]) Focus on the complexities and multi-disciplinary activities of printmaking. Development of concepts and personally significant imagery leading to thesis work.

Arts 8600. Electronic Art: Theory and Practice. (3 cr [max 12 cr]) Tutorial. Issues related to creative visual work using the computer and other technologies. Interactivity, robotics, digitally based conceptual art, and time-based art.

Arts 8700. Photography: Theory and Practice. (3 cr [max 12 cr]) Contemporary issues in the production of photographic imagery.

Arts 8800. Ceramics: Theory and Practice. (3 cr [max 12 cr]; A-F only) Tutorial emphasizing individual goals and directions. Discussion of aesthetics, history, theory, contemporary issues in clay, and criticism.


Art History (ArtH)

Department of Art History

College of Liberal Arts

ArtH 5101. Myths in Art: Cross-Cultural Comparison. (3 cr; A-F only) Relationships of text/image, efficacy of each in conveying meaning. Properties of visual/verbal communication. Ways in which artists convey mythological meanings, how much these ways differ according to place/time. Students prepare/prepare visual presentations through Web pages.

ArtH 5103. Hellenistic and Early Roman Art and Archaeology. (3 cr. §CNES 5103. Prereq—Class/ArtH 3008, jr or #) Sculpture, architecture, painting, and topography in developing centers of Hellenistic culture in the eastern Mediterranean, and in Etruscan and Roman towns from 400 B.C. to the beginnings of the Roman Empire.

ArtH 5106. Greek Architecture. (3 cr. §CNES 5108. Prereq—ArtH/Class 3008, jr or sr or grad, or #) Geometric through classical examples of religious and secular architecture and their setting at archaeological sites in Greece, Asia Minor, and Italy.

ArtH 5111. Prehistoric Art and Archaeology of Greece. (3 cr. §CNES 5111. Prereq—jr or sr or grad student, Greek art/archaeology course or #) Artistic and architectural forms of Neolithic period in Aegean area and Cycladic, Minoan, and Mycenaean cultures. Aims and methods of modern field archaeology; the record of human habitation in the Aegean area. Archaeological evidence as a basis for historical reconstruction.
ArTH 5112. Archaic and Classical Greek Art. (3 cr. Prereq.–ArTH 5111) Greek lands from the 9th through 5th centuries B.C. Examination of material remains of Greek culture, archaeological problems such as identifying and dating buildings; analysis of methods and techniques.

ArTH 5112. Archaic and Classical Greek Art. (3 cr. Prereq.–ArTH 5111) Sculpture, painting, and minor arts in ancient art course or #) #) The architecture, painting, and sculpture of urban houses, country estates, and tombs in the Roman World. Relationships between public and private spheres, and literary and physical evidence; usefulness of physical evidence in illuminating gender roles.

ArTH 5182. Art and the State: Public Art in the Roman Empire. (3 cr. §ArTH 5182. Prereq.–One intro art history course or #) Origins of Roman public art; use in maintaining community; exploitation by the first Emperor, Augustus; development and diffusion through the later Empire; varying capabilities to adjust to the demands of a Christian Empire.

ArTH 5234. Gothic Sculpture. (3 cr. Prereq.–ArTH 5112) The origin, character, and development of Gothic sculpture in France, the German empire, and the Netherlands, 1150-1400. Emphasis on French sculpture of the cathedral age and the emergence of a court style in Paris and elsewhere in Europe (e.g. London, Prague).

ArTH 5252. History of Early Christian Art in Context. (4 cr. §ArTH 5252. Prereq.–One 300 ArTH course or #) The role played by art in the formation of early Christian and Byzantine communities, and in establishing their relationships with the Pagan world and early Islam.

ArTH 5301. The Visual Culture of the Atlantic World. (3 cr; A-F only. Prereq.–Grad student or #) Visual culture of Atlantic world, from Columbus to American Revolution. Visual objects, practices considered in context of Europe’s colonization of the Americas. Slavery, religious conflict, international commerce, and production of scientific knowledge addressed in terms of their impact upon visual imagery.

ArTH 5302. Print Culture in Early Modern Europe. (3 cr; A-F only) Historical print of images in Europe from their emergence in 15th century through about 1750. Book illustration, reproductive printmaking, History of print commodification. Prints and scientific knowledge. Role of print culture in major social/political events such as Protestant Reformation.

ArTH 5324. 15th-Century Painting in Northern Europe. (3 cr. Prereq.–ArTH 5112 or grad or #) The origin, character, and development of painting in France, the Netherlands area, and the German Empire during the years 1350 to 1500. Emphasis on the Flemish school (e.g., Van Eyck brothers, Campin, Van der Weyden) and its influences.

ArTH 5340. Practicum in Archaeological Field and Computer Techniques. (3 cr. §ArTH 5340. COV 5340; COVS 5340; ORES 5340) ArTH 5340. Prereq.–One course in ancient art/archaeology or #) Methods for excavation of Old/New World sites. Meets at archaeometry/computer lab for part of semester and at selected site in Minnesota for day-long sessions for 9 to 10 weeks.

ArTH 5411. Gender and Sexuality in Art Since 1863. (3 cr. §ArTH 5411. History of art from late 19th to early 21st century. How gender/sexuality have been central to that period’s artistic production, art criticism, and aesthetic theorization. How gender/sexuality are important themes for historians. How the writing of history reveals assumptions about gender/sex. Critical reading/ writing.

ArTH 5413. Alternative Media: Video, Performance, Digital Art. (3 cr; A-F only. Prereq.–ArTH 5340 or #) In-depth examination of development of alternative media in 20th/21st century art. Video technologies. Performance, time based art. Digital art.

ArTH 5417. Twentieth Century Theory and Criticism. (3 cr. §ArTH 5417. Twentieth-century art theory, historical methodology, criticism. Key philosophical ideas of modernism/postmodernism: formalism, semiotics, poststructuralism, feminism, Marxism, psychoanalysis, deconstruction. Key philosophical ideas of modernism/postmodernism.


ArTH 5463. Early 20th-Century Painting and Sculpture. (3 cr. §ArTH 5463. Primary movements of early 20th century: fauvism, German expressionism, cubism, futurism, dadaism, surrealism, non-objective painting, constructivism, Orphism, early abstraction. Framed against postimpressionism and internationalism at turn of century.

ArTH 5466. Contemporary Art. (3 cr. §ArTH 5466. Survey of the art and important critical literature of the period after 1970. Origins and full development of postmodern and subsequent aesthetic philosophies.

ArTH 5535. Style, Tradition, and Social Content in American Painting: Colonial Era to 1876. (3 cr. §ArTH 5535. America’s colonial, Revolutionary era, and 19th-century painters’ responses to the influence of European aesthetics. Key American painting types: portraiture, rural genre, and landscape from Copley and Gilbert Stuart to the Hudson River School and the chronicles of the Western frontier.

ArTH 5536. Topical Studies in American Art. (3 cr) Course description varies from year to year, depending on the current research interests of the instructor and the needs and interests of advanced undergraduate and graduate students in modern and American art.

ArTH 5546. American Architecture: 1840 to 1914. (3 cr. §ArTH 5546. American architecture from 1840 to 1914, examined in relation to European precedents and American sociohistorical conditions. Critical attention to problems of style, the architectural profession, vernacular vs. “modern” technology, economics, urbanism, and social reform.


ArTH 5725. Ceramics in the Far East. (3 cr) Selective examination of representative pottery and ceramic wares produced in China, Korea, and Japan from the Neolithic era to modern times. Nearly every major ceramic type is represented.

ArTH 5765. Early Chinese Art. (3 cr) Develop a more effective way to understand the unique qualities of an individual work of art. Concentration is on accessible works of art in local private and museum collections.

ArTH 5766. Chinese Painting. (3 cr) Major works from the late bronze age to the modern era that illustrate the development of Chinese landscape painting and associated literary traditions.

ArTH 5767. Japanese Painting. (3 cr) Japanese pictorial arts from the late tomb period to the modern era; special attention to the development of indigenous traditions.

ArTH 5768. Connoisseurship in Asian Art. (3 cr) A selective examination of representative works of art produced in China from the Neolithic era to the Han Dynasty. Major archaeological sites and examples of art in local collections.

ArTH 5775. Formation of Indian Art: 2500 BCE to 300 CE. (3 cr) Sculpture/architecture, from Indus Valley civilization through Kushana period.

ArTH 5776. Redefining Tradition: Indian Art, 400 to 1300. (3 cr) India’s art/architecture, from earliest free-standing temples through 13th century. Focuses on temples, associated sculpture. Mural painting, beginnings of Islamic architecture in India.

ArTH 5777. The Diversity of Traditions: Indian Art 1200 to Present. (3 cr. Prereq.–ArTH art history course or #) Issues presented by sculpture, architecture, and painting in India from the prehistoric Indus Valley civilization to the present day.

ArTH 5781. Age of Empire: The Mughals, Safavids, and Ottomans. (3 cr) Artistic developments under the three most powerful Islamic empires of the 16th through 19th centuries: Ottomans of Turkey; Safavids of Iran; Mughals of India. Roles of religion and state will be considered to understand their artistic production.

ArTH 5785. Art of Islamic Iran. (3 cr) Architecture, painting, and related arts in Iran from the inception of Islam (7th century) through the 20th century. Understanding the nature of Islam in Persianate cultural settings and how artistic production here compares to the Islamic world.

ArTH 5925. History of Photography as Art. (3 cr) Origins and development of photography, with attention to technology and cultural impact. Major aesthetic achievements in photography from its beginning to present.

ArTH 5927. Documentary Cinema. (4 cr) History of nonfiction filmmaking, from early forms of reportage and birth of documentary to emergence of “film-verite” and “guerrilla television” and work by independents (e.g., Errol Morris, Michael Moore).

ArTH 5940. Topics: Art of the Film. (3-4 cr) Topics in film history including individual directors (e.g., Hitchcock, Welles), genres (e.g., westerns, musicals), and other topics (e.g., American independent filmmaking, film noir).

ArTH 5950. Topics: Art History. (2-4 cr; max 12 cr) Topics specified in Class Schedule.

ArTH 5993. Directed Study. (1-4 cr; max 12 cr; A-F only. Prereq.–ArTH 5993. Directed Study. (1-4 cr; A-F only. Prereq.–ArTH 5993. Directed Study. (1-4 cr; A-F only. Prereq.–ArTH 5993. Directed Study. (1-4 cr; A-F only. Prereq.–ArTH 5993. Directed Study. (1-4 cr; A-F only. Prereq.–ArTH 8620. Seminar: Medieval Art. (3 cr max 12 cr) Focus on a major art historical theme, artist, period, or genre.

For definitions of course numbers, abbreviations, and symbols, see page 167.

Arth 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

Arth 8340. Seminar: Baroque Art. (3 cr [max 12 cr]. Prereq–#) Topics vary.

Arth 8400. Seminar: Issues in 19th-Century Art. (3 cr [max 12 cr]. Prereq–#) Typical seminars have included symbolism, role of the academy and the avant-garde, surrealism in art and theory, and Franco-American relationships at the turn of the 20th century.


Arth 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

Arth 8520. Seminar: American Art and Material Culture. (3 cr [max 12 cr]. §AmSt 8520. Prereq–#) Topics in American art, popular art, and material culture, emphasizing methods and techniques of inquiry: creation and use of archives, oral history, sources for pictorial evidence, and current approaches to interpreting traditional and non-traditional data.

Arth 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Arth 8710. Seminar: Islamic Art. (3 cr [max 12 cr]. Prereq–#) Focus depends on current research interests of the professor and needs and interests of graduate students in Islamic and Asian Art.

Arth 8720. Seminar: East Asian Art. (3 cr [max 12 cr]. Prereq–#) Research focuses on closely defined topic, such as a short period of Chinese art, a restricted subject, or role of a single artist. A substantive research paper is required and participation in the seminar dialogue is expected.

Arth 8770. Seminar: Art of India. (3 cr [max 12 cr]. Prereq–3 cr art history, #) Selected problems and issues in history of South Asian art. Topics vary by offering.

Arth 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

Arth 8920. Seminar: Film History and Criticism. (3 cr [max 12 cr]. Prereq–#) Selected topics in film history and theory, including specific directors, genres, movements, periods, and critical issues (e.g., violence).

Arth 8950. Seminar: Issues in the History of Art. (3 cr [max 12 cr]. Prereq–3 cr art history, #) Theoretical or topical issues; topic varies.

Arth 8970. Directed Studies. (1-3 cr [max 12 cr]. Prereq–#)

Asian Languages and Literatures (ALL)  
Department of Asian Languages and Literatures  
College of Liberal Arts


ALL 5357. Chinese Cinematic Realisms. (4 cr) Various styles of realism in Chinese cinema (mainland, Taiwan) from silent era to present. Theories of realism, conceptions of “the Real” applied in close readings of major films, placed in historical context. China’s negotiation of modernity during 20th century.

ALL 5374. Representing the Past: Chinese Myth, Legend, and Ideology. (4 cr) Analysis of texts that contain early Chinese myths, legends, and historical narratives in their construction of an understandable world. How such materials have been incorporated into different cultural formations from later periods, including contemporary popular culture. How they have figured into the construction of China and Chineseess in 20th Century.


ALL 5436. Literature by 20th-Century Japanese Women in Translation. (4 cr) Literary and historical exploration of selected works by Japanese women writers in a variety of genres. All literary texts read in English.


ALL 5636. South Asian Women Writers. (4 cr; A-F only. Prereq–Grad student or advanced undergard) Survey of South Asian women’s writing, from early years of nationalist movement to present. Contemporary writing includes works by immigrant writers. Concerns, arguments, and nuances in works of women writing in South Asia and diaspora.

ALL 5900. Topics in Asian Literature. (1-4 cr [max 16 cr]) Topics specified in Class Schedule.

ALL 5920. Topics in Asian Culture. (1-4 cr [max 16 cr]) Topics specified in Class Schedule.

ALL 5990. Directed Study. (1-4 cr [max 16 cr]. Prereq–#. Δ) Individual reading/study, with guidance of a faculty member, on topics not covered in regular courses.


Ast 5201. Methods of Experimental Astrophysics. (4 cr. Prereq–Upper div or grad or #) Contemporary astronomical techniques and instrumentation. Emphasizes data reduction and analysis, including image processing. Students make astronomical observations at Brit Observatory and use department’s computing facilities for data analysis. Image processing packages include IRAF, AIPS, IDL, MIRA.

Ast 8001. Radiative Processes in Astrophysics. (4 cr. Prereq–#) Introduction to classical/quantum physics of electromagnetic radiation as it applies to astrophysics. Emphasizes radiative processes (e.g., emission, absorption, scattering) in astrophysical contexts (e.g., ordinary stars, ISM, neutron stars, active galaxies).

Ast 8011. High Energy Astrophysics. (4 cr. Prereq–#) Energetic phenomena in the universe. Radiative processes in high energy regimes; supernovae, pulsars, and X-ray binaries; radio galaxies, quasars, and active galactic nuclei.


Ast 8041. Comparative Planetology. (4 cr. Prereq–#) Overview of current knowledge of the solar system. Formation history of protostellar nebula, physical properties of major planetary bodies/moons. Sun and fossils of epoch of planetary system formation: comets, asteroids, minor bodies.

Ast 8051. Galactic Astronomy. (4 cr. Prereq–#) Content, structure, evolution, and dynamics of Milky Way Galaxy. Emphasizes recent observations from space-/ground-based telescopes.


Ast 8081. Cosmology. (4 cr. Prereq–#) Role of gravity in cosmology. Background, recent research advances.

Ast 8110. Topics in Astrophysics. (2-4 cr [max 4 cr]. Prereq–#)

Ast 8120. Topics in Astrophysics. (2-4 cr [max 4 cr]. Prereq–#)

Ast 8200. Astrophysics Seminar. (1-3 cr [max 3 cr]. Prereq–#)

Ast 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

Ast 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

Ast 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)
Bio-based Products (BP)

College of Natural Resources

BP 5001. Chemistry of Plant Materials. (4 cr; A-F only. §BP 4001. Prereq—Grad student or #) Chemical principles underlying structure, properties, processing, and performance of plant materials.

BP 5002. Fundamentals of Bio-renewable Resources. (3 cr. A-F only. Prereq—Max 18 cr per semester or summer; 10 cr total required (Max A-F only))

BP 5003. Surface and Colloid Science in Bio-based Products Manufacturing. (3 cr. §BP 4301. Prereq—Grad student or #) Principles of surface and colloid science, their application to manufacturing/ performance of bio-based products.

BP 5030. Organisms Impacting Bio-based Products. (3 cr. §BP 4302. Prereq—Grad student or #) Organisms and their importance to bio-based products: deterioration, control, bioprocesses for benefit.

BP 5033. Bio-based Materials Science. (3 cr. §BP 4303. Prereq—Grad student or #) Basic principles of materials science, their application to bio-based materials.


BP 5312. Manufacturing and Applications of Bio-based Products. (4 cr. §BP 4411W. Prereq—Grad student or #) Manufacturing processes, end-use applications of bio-based products.

BP 5413. A Systems Approach to Residential Construction. (3 cr. §BP 4413. Prereq—Grad student or #) Dynamic/interrelated issues of energy, moisture control, indoor air quality in residential buildings. Emphasizes design, construction, and operational aspects to provide an energy efficient, durable structure, and healthy living environment. Interaction between moisture and wood products within building system.

BP 5414. Advanced Residential Building Science. (3 cr. §BP 4414. Prereq—Grad student or #) Building science theory, advanced applications for residential buildings. Focuses on heat/mass transfer.

BP 5415. Advanced Residential Building Science Lab. (1 cr; A-F only. §BP 4415. Prereq—Grad student or #) Concurrent with 4414. Exercises on advanced applications of heat/mass transfer to predict performance of residential buildings.


BP 8300. Research Problems. (1-10 cr; max 10 cr. Prereq—#) Independent research under faculty guidance.

BP 8303. Advanced Topics in Panel Products Technology. (2 cr. Prereq—#) Particle/ fiber processing, additives, press cycle, design of panels for specific end uses.


BP 8306. Graduate Seminar. (1 cr max 3 cr) Communication of scientific knowledge related to wood and paper science through the media of poster sessions, oral presentations, and the Internet.


Biochemistry (BioC)

Department of Biochemistry, Molecular Biology, and Biophysics

College of Biological Sciences


BioC 5309. Biocatalysis and Biodegradation. (3 cr. §MicB 5309. Prereq—biochemistry or organic chemistry, knowledge of wordprocessing, e-mail, access to World Wide Web, access to college-level science library) Assess validity of information on biocatalysis and biodegradation; learn fundamental aspects of microbial catalytic metabolism as it pertains to biodegradation of environmental pollutants; biocatalysis for specialty chemical synthesis; display of this information on the Web.


Courses

BioC 5401. Advanced Metabolism and Its Regulation. (3 cr. Prereq–Pr0301 or 4331 or Biol 301)
Underlying principles that determine metabolism of common/unusual compounds in plants, animals, microorganisms. Regulation of carbon, energy flow in whole organisms.

BioC 5444. Muscle. (3 cr. SPS 4444. Prereq–BioC 3021 or 4331 or Biol 301)
Muscle structure/function: molecular mechanism by which force is generated.

BioC 5527. Introduction to Modern Structural Biology. (4 cr. Prereq–Intro biochemistry, intro physics) or physical chemistry or #)
Methods employed in modern structural biology to elucidate macromolecular structures. Primary focus on X-ray diffraction, nuclear magnetic resonance (NMR) spectroscopy and mass spectrometry. Principles underlying structural biology and structure/function relationships.


BioC 5531. Macromolecular Crystallography I: Fundamentals and Techniques. (1 cr; S-N only. Prereq–[One organic chemistry or biochemistry course], [two calculus or college physics courses] or instr approval) Macromolecular crystallography for protein structure determination/engineering. Determining macromolecule structure by diffraction.


BioC 8002. Molecular Biology and Regulation of Biological Processes. (4 cr [max 5 cr]. Prereq–BMBB or MCD&B&G grad student or #)

BioC 8084. Research and Literature Reports. (1 cr [max 5 cr]; S-N only. Prereq–Grad BMBB major or #)
Current developments.

BioC 8194. Graduate Seminar. (1 cr [max 5 cr]; S-N only. Prereq–Grad BMBB major or DGS consent) Reports on recent developments in the field and on research projects in the department.

BioC 8213. Selected Topics in Molecular Biology. (4 cr. S/GOD 8213. Prereq–8002 or #)
Current topics such as DNA replication, recombination and gene conversion, regulation of gene expression, chromatin structure and transcription, developmental gene regulation, organellar gene expression. RNA splicing, initiation/control of translation, animal viruses, transposable elements, somatic recombination, oncogenes.

BioC 8216. Signal Transduction and Gene Expression. (4 cr. Prereq–8002 or #)
Cell signaling, metabolic regulation in development. Prokaryotic/eukaryotic systems used as models for discussion. Literature-based course.

BioC 8290. Current Research Techniques. (1-3 cr [max 9 cr]; S-N only. Prereq–Grad BMBB major)
Research project carried out in laboratory of a staff member.

BioC 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

BioC 8401. Ethics, Public Policy, and Careers in Molecular and Cellular Biology. (1 cr [max 2 cr]; S-N only. Prereq–Grad student [in BMBB or MCD&B&G])

BioC 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

BioC 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

BioC 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

BioC 8888. Thesis Credit:Doctoral. (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

Bioinformatics (Biof) Department of Laboratory Medicine and Pathology

Medical School
Biof 5480. Bioinformatics Journal Club. (1 cr [max 12 cr]; S-N only) Bioinformatics Journal Club
Biof 5490. Topics in Bioinformatics. (1-6 cr [max 12 cr]. Prereq–#)
Independent or group study in bioinformatics.

Biology (Bio)

College of Biological Sciences
College of Biological Sciences

Bioi 5407. Ecology. (3 cr. Biol 3407, Biol 3807, EEB 3001. Prereq–[(1001 or 1009 or equiv), (Math 1142 or Math 1271 or equiv), grad or inst consent]) Principles of population growth/interactions and ecosystem function applied to ecological issues, including regulation of human populations, dynamics/impacts of disease, invasions by exotic organisms, habitat fragmentation, and biodiversity. Lab

Bioi 5409. Evolution. (3 cr. Biol 3409. Prereq–((1001 or 1009), grad or #)

Bioi 5511. Teaching the Biological Sciences. (3 cr; A-F only. Prereq–6 cr in the life sciences)
Methods and teaching styles used by outstanding university teachers including reviews and critiques from research on teaching. Opportunities for students to practice and evaluate teaching strategies.

Bioi 5910. Special Topics in Biology for Teachers. (1-4 cr [max 12 cr]. Prereq–BA or BS in science or science education or elementary education or K-12 licensed teacher) Courses developed for invasions-12 teachers depending on topics or subtopics which might include any of the following: plant biology, animal biology, genetics, cell biology, biochemistry, microbiology.

Bioi 5913. Biology for Teachers: Monarchs in the Classroom. (3 cr. Prereq–[Elementary or middle school or high school or preserve] teacher or #, application)
Two-week summer workshop. Week one focuses on monarch butterfly biology taught through fieldwork, labs, lecture and research projects. A 2- to 3-week break follows, when students raise monarchs, conduct simple experiments. Week two focuses on designing classroom activities/projects based on monarch biology, Follow-up meetings held during academic year.

Biomedical Engineering (BME)

Biomedical Engineering Department of Technology
BME 5001. Advanced Biomaterials. (3 cr; A-F only. Prereq–3301 or Math 3011 or grad student or #)
Commonly used biomaterials. Chemical/physical aspects. Practical examples from such areas as cardiovascular/orthopedic applications, drug delivery, and cell encapsulation. Methods used for chemical analysis and for physical characterization of biomaterials. Effect of additives, stabilizers, processing conditions, and sterilization methods.

BME 5041. Tissue Engineering. (3 cr. Prereq–IT upper div or grad student or med student or #)
Fundamentals of wound healing and tissue repair; characterization of cell-matrix interactions; case study of engineered tissues, including skin, bone marrow, liver, vessels, and cartilage; regulation of biomaterials and engineered tissues.

BME 5101. Advanced Bioelectricity and Instrumentation. (3 cr. Prereq–IT upper div, grad student or #)
Instrumentation, computer systems, and processing requirements for clinical physiological signals. Electrode characteristics, signal processing, and interpretation of physiological events by ECG, EEG, and EMG. Measurement of respiration and blood volume/flow.

BME 5102. Bioelectric Measurements and Therapeutic Devices I. (3 cr. Prereq–5101 or #)
Theory/application of electrical stimulation in areas of therapeutic/funneuronal neuromuscular stimulation and pain control, cardiac pacing, defibrillation, tissue healing, and electrotherapy. Safety of electric fields. Electrical tissue impedance measurements.


BME 5201. Advanced Biomechanics. (3 cr. Prereq–[(3001 or equiv), (IT upper div or grad student or #]) Introduction to biomechanics of musculoskeletal system. Anatomy, tissue material properties. Kinematics, dynamics, and control of joint/muscle movement. Analysis of forces/motions within joints. Application to injury, disease. Treatment of specific joints, design of orthopedic devices/implants.

BME 5212. Tissue Mechanics. (2 cr; A-F only. Prereq–5201 or MSE 5301) Fundamental principles of continuum mechanics applied to physiological systems. Systematic consideration of individual tissues and organs. Relationships among histology, anatomy, physiology, and mechanical function in these tissues. Changes in mechanical properties related to pathology. Emphasizes tissues in the cardiovascular system.

BMEn 5351. Cell Engineering. (3 cr. Prereq.–5301 or equiv, 5310 or equiv, IT upper div or grad student or #) Survey of engineering approaches to cell-related phenomena important to cell and tissue engineering: receptor/ligand binding, trafficking and signaling processes; applications to cell proliferation, adhesion, and motility; cell-matrix interactions.

BMEn 5371. Biomedical Applications of Heat Transfer in Humans. (3-4 cr [max 4 cr]. Prereq.–5301, 5307, 5061) Overview of physiology underlying thermoregulation in humans, clinical applications of heat transfer in humans, framework for design project.

BMEn 5401. Advanced Functional Biomedical Imaging. (3 cr; A-F only. Prereq–IT upper div or grad student or #) Functional biomedical imaging modalities. Principles/applications of representative functional imaging technologies that offer high spatial resolution or temporal resolution. Emphasizes principles and methodological foundations of bioelectromagnetic imaging and magnetic resonance imaging. Other functional biomedical imaging modalities.

BMEn 5444. Muscle. (3 cr) Muscle structure/function: molecular mechanism by which force is generated.


BMEn 5502. Pathobiology of Medical Devices. (3 cr; A-F only. Prereq–IT upper div or grad student) Biological response to biomaterials presented in context of fundamental principles of cell injury, adaptation, repair, or death. Diversity of medical uses of biomaterials, by organ system. Unique features of specific biological systems in which medical devices are used.

BMEn 5910. Special Topics in Biomedical Engineering. (1-4 cr [max 4 cr])

BMEn 5920. Special Topics in Biomedical Engineering. (2-4 cr [max 4 cr])

BMEn 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

BMEn 8401. New Product Design and Business Development. (4 cr; A-F only. $Entr 4041, Entr 6087, ME 8221, OMS 6061. Prereq–IT grad student or CSOM grad student), some design experience; 8401, 8402 must be taken same yr) Student teams work with IT and CSOM faculty and company representatives to develop a product concept for sponsoring company. Assignments include concept/detail design, manufacturing, marketing, introduction strategy, profit forecasting, production of product prototype.

BMEn 8402. New Product Design and Business Development. (4 cr; A-F only. $ME 8222. Prereq–$ME 8222; 8401) Student teams work with IT and CSOM faculty and company representatives to develop a product concept for sponsoring company. Assignments include concept/detail design, manufacturing, marketing, introduction strategy, profit forecasting, production of product prototype.

BMEn 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

BMEn 8601. Biomedical Engineering Seminar. (1 cr; S-N only) Lectures and demonstrations of university and industry research introducing students and faculty to methods and goals of biomedical engineering.

BMEn 8602. Biomedical Engineering Seminar. (1 cr; S-N only) Lectures and demonstrations of university and industry research introducing students and faculty to methods and goals of biomedical engineering.

BMEn 8630. Biomedical Engineering Graduate Student Seminar. (1 cr [max 3 cr]; S-N only. Prereq–Grad BMEn major) Student presentations of current thesis research or other areas of biomedical engineering.

BMEn 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

BMEn 8710. Directed Research. (1-3 cr [max 3 cr])

BMEn 8720. Internship in Biomedical Engineering. (3 cr; S-N only. Prereq–Grad BMEn major) Supervised lab or industrial experience unrelated to student’s normal academic or employment experience.

BMEn 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr]. Prereq–Max 18 cr per semester or summer; 16 cr total required) (Plan A only)

BMEn 8880. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

BMEn 8890. Special Topics in Biomedical Engineering. (1-4 cr; A-F only) Topics in biomedical engineering.

BMEn 8910. Independent Study. (1-3 cr [max 3 cr]. Prereq–Grad BMEn major) Research or study of a topic determined by interests of student with professor. Supervises requirements. Requires approval by faculty supervisor and director of graduate studies.

Biomedical Science (BMSc)

Medical School

BMSc 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

BMSc 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

BMSc 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

BMSc 8990. Research: Biomedical Sciences. (1-7 cr [max 42 cr]. S-N only. Prereq–Enrollment in MD/PhD program) Content determined by interest of student in consultation with staff.

Biophysical Sciences (BPhy)

School of Physics and Astronomy

Institute of Technology and Medical School

BPhy 5138. Research Seminar. (1-5 cr [max 5 cr]; S-N only) Topics introduce techniques/goals of biophysical sciences and medical physics. Lectures/demonstrations.

BPhy 5139. Seminar and Journal Club. (1 cr [max 2 cr]; S-N only) Current research/topics related to goals/methods of biophysical sciences and medical physics. Lectures/discussions.


BPhy 5171. Medical and Health Physics of Imaging I. (3 cr. §Rad 7171, §Rph 5170 or #) Physics of diagnostic imaging: specification/quantification of image quality, X-ray production, image receptors, magnetic resonance imaging, radiation exposure and protection. Special imaging techniques, including mammography, computed tomography, and direct digital image capture.


BPhy 5174. Medical and Health Physics of Imaging II. (3 cr. §Rrad 7174. Prereq–IT or #) Physics of diagnostic imaging. Ultrasound, theoretical/experimental applications of radioutrades in medicine and biology. Counting statistics and imaging systems associated with radiopharmaceuticals, radiation dosimetry, and safety in nuclear medicine.

BPhy 8147. Advanced Physics of Magnetic Resonance Imaging (MRI). (3 cr. Prereq–5174 or #) NMR (nuclear magnetic resonance) and MRI physics, spatial selection and encoding, imaging hardware and system engineering. Imaging sequences, associated contrast/resolution. Recent developments in MRI.


BPhy 8293. Directed Study in Biophysical Sciences and Medical Physics. (1-12 cr [max 12 cr]. Prereq–IT) Individualized study under faculty direction.

BPhy 8294. Directed Research in Biophysical Sciences and Medical Physics. (1-12 cr [max 12 cr]. Prereq–IT) Individualized research under faculty direction.

BPhy 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

BPhy 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

BPhy 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

BPhy 8667. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

BPhy 8990. Research: Biophysical Sciences. (1-7 cr [max 42 cr]. S-N only. Prereq–Enrollment in MD/PhD program) Content determined by interest of student in consultation with staff.

For definitions of course numbers, abbreviations, and symbols, see page 167.
Courses

Biosystems and Agricultural Engineering (BAE)

Institute of Technology and College of Agricultural, Food and Environmental Sciences

BAE 5095. Special Problems. (1-5 cr [max 5 cr]. Prereq–¶) Advanced individual–study project. Application of engineering principles to specific problem.

BAE 5203. Environmental Impacts of Food Production. (3 cr. §AEG 5203. Prereq–intended for non-engineering students) Crop production intensity, animal raising options, food processing waste alternatives, pest control.

BAE 5212. Safety and Environmental Health Issues in Plant and Animal Production and Processing. (3 cr. §A-F only. §AEG 5212. Prereq–graduate student or cr or ¶) Application of safety principles to plant and animal production environments. Safety issues, hazards, and risk assessments.

BAE 5513. Watershed Engineering. (3 cr. Prereq–2023, upper div IT) Application of engineering principles to managing surface runoff from agricultural, range, and urban watersheds. Design of facilities and selection of land use practices for controlling surface runoff to mitigate problems of flooding, flooding, erosion, and sedimentation.

BAE 8001. Seminar. (1 cr; S-N only. Prereq–¶) Presentation and discussions on current research topics, research philosophy and principles, proposal writing, and professional presentations.

BAE 8002. Research Seminar I. (1 cr [max 2 cr]; S-N only. Prereq–8001 or 12001 or equiv) Organization/curriculum of seminars on new developments in biosystems and agricultural engineering.

BAE 8003. Research Seminar II. (1 cr [max 2 cr]; S-N only. Prereq–8002 or equiv) Advanced critique seminars in biosystems and agricultural engineering.

BAE 8005. Supervised Classroom or Extension Teaching Experience. (2 cr; S-N only. §AEG 8005, Hort 8005, Ppa 8005, Soil 8005) Teaching experience is offered in the following departments: Biosystems and Agricultural Engineering; Agriculture and Plant Genetics, Horticultural Science, Soil, Water, and Climate. Plant Pathology. Discussions about effective teaching to strengthen skills and develop a personal teaching philosophy.


BAE 8094. Advanced Problems and Research. (2-6 cr [max 6 cr]. Prereq–5095) Advanced research in the students’ areas of interest.

BAE 8103. Machinery Modeling. (3 cr. Prereq–AEI 2021, CE 3520) Students review models presented in the literature and report on limitations and improvements developed in the students’ areas of interest.

BAE 8233. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

BAE 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)
Courses

BIE 5475. Curriculum Development for Business and Marketing Education (3 cr; A-F only) Introduction to conceptual models for design/delivery of business/marketing education programs in secondary/postsecondary schools, in adult education settings, and in business/industry. Preparing programs of instruction for secondary/postsecondary level. Making decisions regarding course content.  

BIE 5596. Occupational Experience in Business and Industry. (1-10 cr; max 10 cr; S-N only. Prereq—84) Observation/employment in business/industry to develop technical/occupational competencies. Includes 100 clock hours of supervised work experience per credit.  

BIE 5597. Internship: Business and Industry Education. (1-8 cr; max 12 cr; S-N only. Prereq—84) Practical experience in business or industry as a professional educator or supervisor. Requires an integrative paper.  


BIE 5624. Sales Training. (3 cr; A-F only. §HRD 5624) Training competent customer service employees as part of a marketing strategy. Explore training strategies using the appropriate instructional methods for different settings and situations.  

BIE 5625. Technical Skills Training. (3 cr. §HRD 5625) Analyze technical skills and training practices in business and industry; systems and process analysis; trouble-shooting of work behavior; design methods and developing training materials.  

BIE 5626. Customer Service Training. (3 cr; A-F only §HRD 5626) Overview of customer service strategies used by successful organizations and training practices used to develop customer-oriented personnel.  

BIE 5627. Management and Supervisory Development. (3 cr §HRD 5627) Problems, practices, programs, and methodologies relating to the training and development of managers and supervisors, including needed competencies, needs assessment, delivery modes, and evaluation.  

BIE 5628. Multimedia Presentations in Business. (3 cr §HRD 5628. Prereq—5011 or equiv) Designing, creating, and presenting information using multimedia resources in business settings.  

BIE 5662. Computer Training in School and Industry Settings. (3 cr. §HRD 5662. Prereq—5011 or equiv) Alternative teaching practices for business applications software: word processors, spreadsheets, graphics, desktop publishing, databases, and communications; public school and industry settings.  

BIE 5706. Field Based Projects in Business and Industry. (1-4 cr; max 4 cr; S-N only) Curricular, instructional, developmental, or evaluative problems and projects applicable to local school or business and industry situations.  

BIE 5801. The Business of Tourism. (3 cr; A-F only) Introduction to major theories, concepts, skills, and techniques influencing tourism business/industry.  


BIE 5803. Tourism Studies Capstone Seminar. (3 cr; S-N only. Prereq—Tourism studies major) Students present, critique, and discuss implications of supporting programs for tourism.  

BIE 5993. Directed Study in Business and Industry. (1-4 cr; max 4 cr) In-depth individual inquiry in the content areas related to business and industry.  

BIE 5895. Research Problems: Business and Industry. (3-6 cr; max 6 cr; S-N only. Prereq—Advisor approval) Individual research in business and industry education.  

Business Law (BLaw)  

Department of Accounting  

Curtis L. Carlson School of Management  

BLaw 5078. Partnerships and Corporations. (2 cr) Partnership and corporate forms of business entities, including methods of creating the relationships and the study of law used to regulate and control these organizations and their members.  

BLaw 5068. Law of Personal Property, Real Property, and Commercial Paper. (2 cr) Basic concepts of personal property, including rights of possessors, bailees, and finders and holders of security interests. Real property law. Transfers of ownership, control of and encumbering such interests. The law of paper (negotiable instruments).  

Center for Spirituality and Healing (CSPh)  

Health Sciences  

CSPh 5000. Explorations in Complementary Therapies and Healing Practices. (1-4 cr; max 12 cr. Prereq—36 or sr or grad student or #) Research/practice on therapies, delivery of complementary therapies, regulatory issues.  

CSPh 5011. Introduction to Complementary Healing Practices. (3 cr. Prereq—Jr or sr or grad student or #) Cultural contexts of healing traditions. Complementary therapies presented by practitioners, including traditional Chinese medicine, meditation, mind-body healing, spiritual practices, energy healing, naturopathy, herbalism, movement therapies, homeopathy, manual therapies, and nutrition.  

CSPh 5102. Art of Healing: Self as Healer. (1 cr. Prereq—Jr or sr or grad student or #) Introduction to individual transformational journey as part of health science education. Students become aware of their responsibility/resources to facilitate development of the self. Research data, experience of self that is part psychoneuroimmunology, mind-body-spirit approaches. Lecture, scientific literature, meditation, imagery, drawing, group interaction.  

CSPh 5111. Ways of Thinking about Health. (2 cr. Prereq—Jr or sr or grad student or #) Diverse healing traditions of selected cultures. Use of herbal medicines as essential component of social structure. Links between nature, humans, and indigenous healers. Use of foods as healing medicines in India, China, and ancient Greece. Connection between spirituality and healing powers in indigenous/modern cultures. Rise of scientific traditions, their influence on ways of thinking about healing.  

CSPh 5115. Cultural Knowledge, Health, and Contemporary Cultural Communities. (3 cr. Prereq—Jr or sr or grad student or #) How personal cultural experience affects one’s professional practice. Wisdom of cultural communities. Cultural construct underpinning the medical system. Role of culture in interaction between practitioner and patient. Reconnecting to cultural heritage in healing.  

CSPh 5201. Spirituality and Resilience. (2 cr. Prereq—Jr or sr or grad student or #) Links between resilience and spirituality. Applications of resilience/health realization model to students’ personal/professional lives. Review of literature, theory, and research.  

CSPh 5211. Peacemaking and Spirituality: A Journey Toward Wholeness. (2 cr. Prereq—Jr or sr or grad student or #) Influence of spirituality upon process of resolving conflict and making peace in intense interpersonal/personal conflicts in mind body, social, and political settings, including in families, between patients/clients and nurses/social workers, within communities, among friends, between co-workers, or within ourselves.  

CSPh 5215. Forgiveness and Healing: A Journey Toward Wholeness. (2 cr. Prereq—Jr or sr or grad student or #) Impact of forgiveness on process of inter/intra-personal healing. Forgiveness/healing in health care and social work settings from multiple spiritual/secular traditions.  

CSPh 5221. Significant Spiritual Texts of the 20th Century. (3 cr. Prereq—Jr or sr or grad student or #) Diverse “spiritual classics” (i.e., elements of western canon that have proven over time to be resources of values). Resources of meaning for inner-life healers. How to establish a personal library for life-long journey of spiritual development.  

CSPh 5225. Meditation: Integrating Body and Mind. (2 cr. Prereq—Jr or sr or grad student or #) Meditation as a physical, emotional, intellectual, and spiritual inquiry. Students examine a variety of texts and develop ability to enter a state of calm, meditative awareness.  

CSPh 5226. Advanced Meditation: Body, Brain, Mind, and Universe. (1 cr. Prereq—5225 or j or sr or grad student or) Students work to integrate meditation practice into daily life, cultivating awareness of the fundamental oneness of body, brain, mind, and universe. Mind-body interactions in health. “Hard problem” of consciousness in brain science. Emergence of non-dual consciousness. Compassion, wisdom, and healing in non-discriminative awareness.  

CSPh 5301. Cultures, Faith Traditions, and Health Care. (2 cr; A-F only. Prereq—Jr or sr or grad student or #) Culturally/spiritually based health care practices of selected native/immigrant populations in Minnesota. Clinical implications. Personal/professional conflicts for delivery of competent care to culturally diverse groups by those trained in Western health care.  

CSPh 5311. Introduction to Traditional Chinese Medicine. (2 cr; A-F only. Prereq—Jr or sr or grad student or #) Philosophical roots of Shamanism, Confucianism, Taoism, and Buddhism. Influence of these philosophies on Chinese medicine. Evolution of concepts of the Tao, Yin-Yang, macrocosm, microcosm. Development of herbal medicine, Tui Na, Qi Gong, acupuncture, moxibustion. Traditional Chinese medicine etiology of disease, physiology, diagnosis, therapy, disease prevention, ethics, psychology, cosmology.  

CSPh 5315. Traditional Tibetan Medicine: Ethics, Spirituality, and Healing. (2 cr; A-F only. Prereq—Jr or sr or grad student or #) Ethics, spirituality, and healing from perspective of traditional Tibetan medicine. Belief that illness results from imbalance and that treating illness requires correcting underlying imbalance. How to apply these principles, integrate them into clinical practice, and consult with a traditional Tibetan doctor.  

CSPh 5317. Yoga: Ethics, Spirituality, and Healing. (2 cr. Prereq—5301, 5315 or #) Ethics, spirituality, and healing from perspective of yoga, an ancient Indian discipline. Students test the claim that systematic yoga practice leads to optimal health. Evaluating yoga’s philosophy, scientific evidence, practical application. Students propose research-based programs for integrating yoga into personal/professional life.
Courses

CSpH 5321. Public Health Priorities in the Developing World. (2 cr; 6MND 7567, Prereq–Jr or sr or grad student or §) Primary public health problems, priorities, and interventions in developing countries. Issues related to culture/indigenous health systems and of concern to health providers who work abroad or with refugee communities in countries of resettlement.

CSpH 5325. Latino: Culture and Health. (3 cr; Prereq–Jr or sr or grad student or §) How Latino world view (cosmovision) affects health and compares with U.S. perspective. Differences in perception of time, family involvement, community “belonging,” gender roles, and communication styles. Folkloric beliefs. Specific issues such as AIDS, pregnancy, women’s issues, pharmacy, and nutrition. Health issues of workers. Cultural competency.

CSpH 5331. Foundations of Shamanism and Shamanic Healing. (2 cr; S-N only. Prereq–Jr or sr or grad student or §) 3.5-day retreat intensive. Shamanic philosophies, ritual etiquette, Core beliefs common to all shamanic healing practices. Cross-cultural healing beliefs/ practices, unique psychology for understanding them, their use with contemporary healing practices and for personal growth.

CSpH 5332. Global Healing Traditions: Amazonia Plant Spirit Medicine. (2 cr; S-N only. Prereq–[5331, [grad student or § or sr or in health science or practicing health professional]] or §) Non-biomedical traditional healing paradigms as practiced in other parts of the world. Focuses on indigenous healing practices in Peru as directed by a local shaman.

CSpH 5401. People, Plants, and Drugs: Introduction to Ethnopharmacology. (3 cr; Prereq–Jr or sr or grad student or §) Biologically active substances used in traditional cultures. Ethnopharmacology’s past, current, and potential contributions to human knowledge. Concrete examples.

CSpH 5405. Plants in Human Affairs. (4 cr. Prereq–Jr or sr or grad student or §) Twelve-day, intensive course. Introduction to ethnobotany/ethnopharmacology. Lectures, field trips, presentations by local experts.


CSpH 5421. Botanical Medicines in Complementary Healthcare. (3 cr. Prereq–Jr or sr or grad student or §) Widely-used botanical medicines from biomedical perspective. Alternative therapeutic systems presented according to bodily systems/processes. Evidence for therapeutic use. Botanical characteristics, traditional uses, chemical properties, dosage, hazards/safety issues, quality control.

CSpH 5431. Functional Nutrition: An Expanded View of Nutrition, Chronic Disease, and Optimal Health. (2 cr. Prereq–Jr or sr or grad student in Health Sciences or §) Principles of nutrition related to metabolic function. Model attempts to reduce chronic disease by looking for underlying causes/triggers and to intervene to restore function and achieve optimal health. Emphasizes importance of nutrition as a component of self-care.

CSpH 5501. Therapeutic Use of Plant Essential Oils. (3 cr. Prereq–Jr or sr or grad student or §) Emphasizes healing at spiritual level. Activation of Reiki energy. Symbols that allow for energy transfer through space/time. Using second level Reiki energy for both distance healing and standard Reiki treatment. Students provide Reiki treatments, discuss findings.

CSpH 5532. Global Healing Traditions: Amazonia Plant Spirit Medicine. (2 cr; S-N only. Prereq–[5331, [grad student or § or sr or in health science or practicing health professional]] or §) Non-biomedical traditional healing paradigms as practiced in other parts of the world. Focuses on indigenous healing practices in Peru as directed by a local shaman.

CSpH 5522. Therapeutic Horticulture. (3 cr. Prereq–5101 or Hort 5072 or §) Central elements of therapeutic horticulture in context of multiple health care settings. Evidence-based principles, practices, and applications of therapeutic horticulture. Various plant/plant-related modalities from current research findings are related to populations, using therapeutic horticulture as a treatment intervention.

CSpH 5523. Applications in Therapeutic Horticulture. (2 cr. Prereq–CSpH 5521 or CSpH 5522) How to develop comprehensive program plans in therapeutic horticulture. Evidence-based principles, facilitation techniques in therapeutic horticulture. Systematic programming through documentation, assessment, program development techniques, and evaluation. Leadership training, program plan components, book reviews, reading assignments, comprehensive exam.

CSpH 5533. Introduction to Energy Healing. (2 cr. Prereq–Jr or sr or grad student or §) Healing techniques (Therapeutic Touch, Reiki, acupuncture, reflexology, magnets, homeopathy) that use energy to enhance the body’s ability to heal. Scientific theories. Students interact with practitioners and have the opportunity to experience feeling “energy.”

CSpH 5535. Reiki Healing. (1 cr. S-N only. Prereq–Jr or sr or grad student) History, principles, precepts, and practical application of Reiki energy healing. Alternative energy healing modalities, current research findings. Activation of the Reiki energy, hands position to perform a treatment. Students provide Reiki treatments, discuss findings.

CSpH 5536. Advanced Reiki Healing: Level II. (1 cr. Prereq–5535) Principles/application of Reiki energy healing. Four levels of healing. Emphasizes healing at spiritual level. Activation of Reiki energy. Symbols that allow for energy transfer through space/time. Using second level Reiki energy for both distance healing and standard Reiki treatment. Students provide Reiki treatments, discuss findings. Current literature, research findings.

CSpH 5541. Integrative Psychotherapy. (3 cr. Prereq–5102, [grad student or §]) In depth, experiential-based training. Support for students to practice integrative psychotherapy, mindfulness meditation, and related mind/body approaches to clinical work. Multiple client/patient populations, issues, and settings.

CSpH 5545. Mind-Body Healing Therapies. (2 cr; L-F only. Prereq–Grad student or § or grad student or §) Philosophies/paradigms. Four modalities commonly used in allopathic nursing, medicine and other health professions (biofeedback, hypnosis, imagery/visualization, meditation). Experiential and group discussion format.

CSpH 5555. Introduction to Body and Movement-based Therapies. (2 cr. Prereq–Jr or sr or grad student or §) Approaches of selected somatic therapies, including dance, movement, and body-based therapies. Historical/theoretical perspectives on use of movement, dance, and somatic re-patterning. Demonstrations of techniques. Application of techniques to specific populations/settings.

CSpH 5601. Music, Health and Healing. (2 cr. Prereq–Jr or sr or grad student or §) Use of humor to enhance communication, treatment, and relationships with patients. How to create a positive work environment and outlook. Physiologic effects/benefits of humor/laughter. Humor and spirituality. Connection between positive outlook and health.

CSpH 8100. Special Topics in Complementary Therapy and Healing Practices. (1-6 cr. §max 12 cr.) Critiquing research on complementary therapies (e.g., design, outcome measures). Synthesizing research findings for a therapy. Hypothesizing future directions for research on complementary therapies.


CSpH 8191. Independent Study in Complementary Therapies and Healing Practices. (1-6 cr. Prereq–Grad student in CSpH minor or §) Students propose area for individual study with faculty guidance. Students write proposal, which includes outcome objectives and work plan. Faculty member directs student’s work and evaluates project.

Central Asian Studies (CAS)

Institute of Linguistics, ESL, and Slavic Languages and Literatures

College of Liberal Arts

CAS 5311. Medieval Sages. (3 cr. §MELC 5311, Prereq–background in Iranian, Central Asian, or Islamic studies recommended) Study and discussion of the intellectual life of the region from the rise of the Ghaznavids (A.D. 1000) to the fall of the Timurids (A.D. 1500). Ibn Sina (Avicenna), al-Biruni, al-Ghazali, Rumi, Sa’di, and Firdowsi are among the sages whose lives are examined.

CAS 5326. Islam and Communism. (3 cr. §CAS 3526, MELC 3526, MELC 5526) Development of medieval Islamic culture in Transoxiana; formation of Sufi orders; rise and development of Communist ideology; introduction of socialist principles into Central Asia; clash of Islamic principles with Communist dicta; Pan-Islamism; Pan-Turkism.

CAS 5352. Russia and Central Asia. (3 cr. §CAS 3532, MELC 3532, MELC 5532) Rise and fall of the Mongol Empire, formation of the Chaghatai Khanate and the Golden Horde. Russian expansion into Central Asia and rivalry with Britain. Russia and the Central Asian republics during and after the Soviet period.
Chemical Engineering (ChEn)
Department of Chemical Engineering and Materials Science


ChEn 5221. Introduction to Polymer Chemistry. (3 cr; A-F only. §Chem 5221, Chem 8221, MatS 5221, MatS 8221) Condensed, radicalic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.


ChEn 5596. Special Topics. (1-4 cr [max 4 cr]) New or experimental special topics.

ChEn 5751. Biochemical Engineering. (3 cr; A-F only. Prereq-4002, 4003, 4102) Chemical engineering principles applied to analysis/design of complex cellular/enzyme processes. Quantitative framework for design of cells for production of proteins, synthesis of antibodies with mammalian cells, or degradation of toxic compounds in contaminated soil.


ChEn 5754. Food Processing Technology. (3 cr; A-F only. Prereq-4002) Introduction to food processing as it interfaces with engineering. Case studies. Engineering economics and practical design problems in food processing. Heat transfer/freezeconing, condensation (unsteady state); thermal processing: extruder design; protein processing; order-of-magnitude estimating; and economic concepts such as ROI, discounted cash flow, and capital estimating.

ChEn 5759. Principles of Mass Transfer in Engineering and Biological Engineering. (2 cr; A-F only. Prereq-4002) Principles of mass transfer in gases, liquids, biological and macromolecular solutions, gels, solids, membranes, and capillaries. Porous solids interaction between mass transfer and chemical reaction. Applications in biological, environmental, mineral, and chemical engineering systems.

ChEn 5771. Colloids and Dispersions. (3 cr; A-F only. Prereq—Physical chemistry) Preparation, stability, coagulation kinetics or colloidal solutions. DLVO theory, electrokinetic phenomena. Properties of micelles, other microstructures.


ChEn 6102. Principles and Applications of Rheology. (2 cr; A-F only. Prereq-5101) Deformation and flow of non-Newtonian and viscoelastic fluids, plastic materials, and perfectly elastic solids. Phenomenological and molecular interpretation of rheology of elastomers, polymer melts and polymer solutions, applications of rheology to polymer processing.


ChEn 6115. Electron Microscopy of Soft Matter. (2 cr; A-F only. Prereq—Chemical engineering or materials science/ engineering graduate major or #) Operation principles of transmission electron microscope (TEM) and scanning electron microscope (SEM). How these instruments are applied in study of soft materials (e.g., liquid, semi-liquid material systems). Unique specimen preparation techniques: low image contrast, electron-beam radiation-damage, and limited signal-to-noise ratio. TEM/SEM digital imaging.

ChEn 6201. Applied Mathematics I: Linear Analysis. (3 cr; A-F only. §Math 4761. Prereq—Chemical engineering graduate student or #) Integrated approach to solving linear mathematical problems. Linear algebraic equations. Linear ordinary and partial differential equations using theoretical/numerical analysis and basis of linear operator theory.

ChEn 6202. Applied Mathematics II: Nonlinear Analysis. (2 cr; A-F only. Prereq—Grad-level course in linear analysis, chemical engineering graduate major or #) Nonlinear mathematical problems. Nonlinear ordinary and partial differential equations using theoretical/numerical analysis.


ChEn 6302. Physical Rate Processes II: Mass Transfer. (3 cr; A-F only. Prereq—Chemical engineering graduate student or #) Applications of mass transfer. Membranes, including gas separation and reverse osmosis. Convective drying, release. Dispersion, including examples of pollution modeling. Adsorption/chromatography. Coupled heat/mass transfer, including cooling towers. Double-diffusive effects.

ChEn 8333. FTE: Master’s. (1 cr. Prereq—Master’s student, adviser and DGS consent)

ChEn 8401. Physical and Chemical Thermodynamics. (3 cr; A-F only. Prereq—[Undergraduate [engineering course or chemistry course in thermodynamics], Chemical engineering graduate student] or #) Principles of classical thermodynamics. Introduction to nonequilibrium thermodynamics, with applications in chemical engineering and materials science.

ChEn 8402. Statistical Thermodynamics and Kinetics. (3 cr; A-F only. Prereq—Chemical engineering graduate student or #) Introduction to statistical mechanical description of equilibrium and non-equilibrium matter. Emphasizes fluids, classical statistical mechanics.

ChEn 8444. FTE: Doctoral. (1 cr. Prereq—Doctoral student, adviser and DGS consent)


ChEn 8502. Process Control. (3 cr; A-F only. Prereq—Chemical Engineering graduate major or #) For linear systems: stability, controllability, observability, pole-placement via state feedback state observers, output feedback, and robustness of control systems. For nonlinear systems: solution properties, stability analysis, singular perturbations, feedback linearization via state feedback, and direct synthesis via output feedback.

ChEn 8503. Chemical Rate Processes: Homogeneous Reactions. (3 cr; A-F only. Prereq—Chemical engineering graduate student or #) Description/characterization of chemically reacting systems. Theories of elementary reactions. Experimental methods for investigating elementary reactions. Applications of chemical kinetics to complex reactions, such as combustion, flames, and the atmosphere.

ChEn 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral])


ChEn 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

ChEn 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr. Prereq-Max 18 cr per semester or summer; 24 cr required]
Courses

Chem 8900. Seminar. (1 cr; S-N only) Presentation and discussion of papers concerning newer developments in chemical engineering, materials science, and related fields.

Chem 8901. Seminar. (1 cr [max 9 cr]) Presentation and discussion of papers concerning the newer developments in chemical engineering.

Chem 8902. Seminar: Finite Element Methods of Computer-aided Analysis. (1 cr; A-F only. Prereq-Chemical engineering grad student or #) Fundamentals of finite element method as applied to mathematics. How to construct finite element codes and put them into operation.

Chem 8993. Directed Study. (1-12 cr [max 12 cr]) New or experimental courses offered by department or visiting faculty.

Chem 8995. Special Topics. (1-4 cr [max 4 cr])

Chemical Physics (ChPh)

Institute of Technology

ChPh 8333. FTE: Master's. (1 cr. Prereq-Master’s student, adviser and DGs consent)

ChPh 8444. FTE: Doctoral. (1 cr. Prereq-Doctoral student, adviser and DGs consent)

ChPh 8602. Chemical Physics Seminar. (1 cr. Prereq--Grad chemistry major or #) Weekly seminar series on modern chemical physics and related topics.

ChPh 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq-Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

ChPh 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])

ChPh 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq-Max 18 cr per semester or summer; 24 cr required)

Department of Chemistry


Chem 5201. Materials Characterization. (4 cr. A-F only. Prereq-Grad chemical engineering course or #) Modern tools and techniques for both bulk- and thin-film characterization. Topics may include ion-solid interactions, Rutherford back scattering, secondary ion mass spectrometry, solid-state NMR, x-ray photoelectron spectroscopy, small-angle x-ray/neutron scattering, transmission/scanning electron/probe microscopy, near-field scanning optical microscopy, porosimetry, adsorption techniques, and ellipsometry.


Chem 5223. Polymer Laboratory. (2 cr. §MatS 5223W. Prereq--§MatS 5223, 5221 or 8221 or ChEn 4214 or #) Synthesis, characterization, and physical properties of polymers. Free radical, condensation, emulsion, anionic polymerization. Infrared spectroscopy/gel permeation chromatography. Viscoelasticity, rubber elasticity, crystallization.

Chem 5245. Introduction to Drug Design. (3 cr. A-F only. §MedC 5245, Phar 8245. Prereq--2302 or equiv) Concepts that govern design/discovery of drugs. Physical, organic, medicinal chemical principles applied to explain rational design and mechanism of action drugs.

Chem 5311. Chemistry of Industry. (3 cr [max 4 cr]. Prereq-Grad student or #) Industrial and polymer chemistry technology. Relation of basic properties to industrial utility. Economics, social problems, industrial environment.

Chem 5321. Organic Synthesis. (3 cr. Prereq--2302 or equiv, #) Fundamental concepts, reactions, reagents, structural/ stereochemical issues, and mechanistic skills for organic chemistry.

Chem 5322. Advanced Organic Chemistry. (3 cr. Prereq--2302 or equiv) Topics vary, including natural products, heterocycles, asymmetric synthesis, organometallic chemistry, and polymer chemistry. (See instructor for details.)

Chem 5352. Physical Organic Chemistry. (3 cr. Prereq--2302, 5011 or 8011) Fundamental concepts and mechanistic tools for analysis of organic reaction mechanisms. Solvation, reactive intermediates, gas phase chemistry, photochemistry or strained-ring chemistry or both.

Chem 5361. Interpretation of Organic Spectra. (3 cr. Prereq--2302 or equiv) Application of nuclear magnetic resonance, mass, ultraviolet, and infrared spectral analyses to organic structural problems.

Chem 5412. Chemical Biology of Enzymes. (3 cr. Prereq--2302 or equiv) Enzyme classification with examples from current literature; strategies to decipher enzyme mechanisms; chemical approaches to control enzyme catalysis.

Chem 5413. Nucleic Acids. (3 cr. Prereq--2302 or equiv) Chemistry and biology of nucleic acids. Structure, thermodynamics, reactivity, DNA repair, chemical oligonucleotide synthesis, antisense approaches, ribozymes, techniques for nucleic acid research, interactions with small molecules and proteins.


Chem 5551. Quantum Mechanics I. (3 cr. §Chem 8551. Prereq--Undergrad physical chem course, #) Review of classical mechanics. Postulates of quantum mechanics, with applications to determination of single particle bound state energies and scattering calculations. Techniques of the Schrödinger equation, its solutions, and applications to physical systems. Modern methods (e.g., IR, UV-VIS, ESR, Mossbauer and mass spectroscopy, magnetic measurements, X-ray diffraction) and concepts applied to inorganic and organometallic systems.

Chem 5725. Organometallic Chemistry. (3 cr. Prereq--4701 or equiv, chem major or #) Synthesis, reactions, structures, and other properties of main group and transition metal organometallic compounds; electronic and structural theory, emphasizing their use as stoichiometric and homogeneous catalytic reagents in organic and inorganic systems.

Chem 5735. Bioinorganic Chemistry. (3 cr. Prereq--4701 or equiv, chem grad or #) Role of metal ions in biology. Emphasizes structure, function, and spectroscopy of metalloproteins and their synthetic analogs.

Chem 5745. Advanced Inorganic Chemistry. (3 cr. Prereq--4701, chem major, #) Topics in main group and transition metal chemistry. Emphasizes synthesis, structure, physical properties, and chemical reactivity.

Chem 5755. X-Ray Crystallography. (4 cr. A-F only. Prereq--Chem grad student or #) Essentials of crystallography as applied to modern, single crystal X-ray diffraction methods. Practical training in use of instrumentation in X-ray crystallography facility in Department of Chemistry. Data collection, correction/refinement, structure solutions, generation of publication materials, use of Cambridge Crystallographic Structure Database.


Chem 8025. Introduction to Graduate Research. (1-2 cr [max 2 cr]; S-N only. Prereq--Grad student in chem) New areas of chemistry, hands-on exposure to graduate research. Students rotate through up to two different labs for seven weeks. Labs are run by chemistry graduate faculty members.


Chem 8081. M.S. Plan B Project I. (1-4 cr [max 4 cr]; A-F only. Prereq--Grad chem major) Satisfies project requirement for Plan B master’s degree. May appear on M.S. degree program, but does not count toward 14-credit minimum in major field. Topic arranged with adviser; written report required. 8081 required; 8082 optional.
Chem 8082. M.S. Plan B Project II. (1-4 cr; max 4 cr; A-F only) Prereq–Grad chem major
Satisfies project requirement for Plan B master’s degree. May appear on M.S. degree program, but does not count toward 14-credit minimum in major field. Topic selected by student/advisor; written report required. 8081 required; 8082 optional.

Chem 8151. Analytical Separations and Chemical Equilibria. (4 cr; Prereq–#)
Advanced treatment of principles of analytical chemistry, chemical equilibria, and dynamics. Chromatographic and other modern analytical scale separations techniques. Emphasizes column dynamics and retention mechanisms.

Chem 8152. Analytical Spectroscopy. (4 cr; Prereq–Grad chem major or #)
Survey of analytical spectroscopic methods. Design/ application of spectroscopic instruments, including signal generation, acquisition, and interpretation. May include nuclear magnetic resonance, electron paramagnetic resonance, infrared and ultraviolet/ visible spectroscopy, and mass spectrometry.

Chem 8153. Extracting Signal From Noise. (5 cr; A-F only) Prereq–[4101 or equiv], differential equations course
Use of analog/digital electronics and computational methods in experiments. Passive circuits, operational amplifiers, filters, oscillators and Laplace transform techniques in analysis, domain conversion for data acquisition/control, statistics, experimental design. Introduction to chemometrics, Fourier analysis, convolution/deconvolution, curve fitting.

Chem 8155. Advanced Electroanalytical Chemistry. (2 cr; Prereq–8151)
Polarography, galvanostatic and potentiostatic methodology, coulometry, linear scan and cyclic voltammetry and pulse methods.

Chem 8157. Biocatalytic Chemistry. (4 cr; A-F only)
Theory and practical aspects of analytical methods used in determination characterization of biologically important materials. Enzymatic/kinetic methods in study of proteins, carbohydrates, lipids, and nucleic acids.

Detailed understanding of relaxation processes, chemical exchange, quadrupolar effects, NMR and 2D NMR, NMR hardware, and solid state NMR. NMR Imaging and Pulsed Field Gradient (PFG) NMR are discussed.

Chem 8180. Special Topics in Analytical Chemistry. (2-4 cr; max 4 cr) Prereq–Grad chem major or #
Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8201. Materials Chemistry. (4 cr; A-F only) §Chem 5201, Prereq–[4701, 3502] or #
Crystalline systems/unit cells, phase diagrams, defects/ interfaces, optical/ dielectric properties, electrical/ thermal conductivity, X-ray diffraction, thin film analysis, electronic structure, polarons/phonons, solid state chemistry, liquid/molecular crystals, polymers, magnetic/optical materials, porous materials, ceramics, piezoelectric materials, biomedical materials, catalysts.

Chem 8221. Physical Chemistry of Polymers. (5 cr; max 4 cr) §Mats 8211, Prereq–undergrad physical chem course
Introduction to polymer physical chemistry. Chain conformations; thermodynamics of polymer solutions; blend, solutions; glasses; light, neutron, and X-ray scattering; dynamics in dilute solution and polymer characterization; dynamics of melts and viscoelasticity; rubber elasticity, networks, and gels; glass transition; crystallization.

Chem 8221. Introduction to Polymer Chemistry. (4 cr; Chem 5221, Chem 5221, Mats 5221, Mats 5221, Prereq–[2302, 3501] or #)
Condensation, radical, ionic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.

Chem 8250. Special Topics in Materials Chemistry. (2-4 cr; max 4 cr; A-F only) Prereq–Grad chem major or #
Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8321. Organic Synthesis. (4 cr; Prereq–[2302 or equiv]
Core course; fundamental concepts, reactions, reagents, structural and stereochemical issues, and mechanistic skills necessary for understanding organic chemistry.

Chem 8332. Advanced Organic Chemistry. (4 cr; Prereq–2302 or equiv)
Modern topics, which vary by year, include natural products, heterocycles, asymmetric synthesis, organometallic chemistry, and polymer chemistry.

Chem 8333. FTE Master’s. (1 cr; Prereq–Master’s student, adviser and DGS consent)

Chem 8352. Physical Organic Chemistry. (4 cr; Prereq–[5011 or 8011 or 2302 or equiv])
Fundamental concepts and mechanistic tools for understanding/analyzing organic reaction mechanisms. Solvation, reactive intermediates, gas phase chemistry, photochemistry, strained-ring chemistry.

Chem 8351. Interpretation of Organic Spectra. (4 cr; Prereq–2302 or equiv)
Practical application of nuclear magnetic resonance, mass, ultraviolet, and infrared spectral analyses to solution of organic structural problems.

Chem 8380. Special Topics in Organic Chemistry. (2-4 cr; max 4 cr)
Prereq–Grad chem major or #
Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8411. Introduction to Chemical Biology. (4 cr; Prereq–2302 or equiv)
Chemistry of amino acids, peptides, proteins, lipids, carbohydrates, and nucleic acids. Structure, nomenclature, synthesis, and reactivity. Overview of techniques used to characterize these biomolecules.

Chem 8412. Chemical Biology of Enzymes. (4 cr; Prereq–2302 or equiv)
Enzyme classification with representative examples from current literature. Strategies used to decipher enzyme mechanisms. Chemical approaches for control of enzyme catalysis.

Chem 8413. Nucleic Acids. (4 cr; Prereq–2302 or equiv)
Chemistry and biology of nucleic acids: structure, thermodynamics, reactivity, DNA repair, chemical oligomucleotide synthesis, antisense approaches, ribozymes, overview of techniques used in nucleic acid research, interactions with small molecules and proteins.

Chem 8444. FTE: Doctoral. (1 cr; Prereq–Doctoral student, adviser and DGS consent)

Chem 8480. Special Topics in Biological Chemistry. (2-4 cr; max 4 cr) Prereq–Grad chem major or #
Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8514. Dynamics. (4 cr; Chem 5541, Prereq–Undergrad physical chem course)

Chem 8551. Quantum Mechanics I. (4 cr; Chem 5551, Prereq–Undergrad physical chem course)
Review of classical mechanics. Postulates of quantum mechanics with applications to determination of single particle bound states energies and scattering cross-sections in central field potentials. Density operator formalism with applications to description of two level systems, two particle systems, entanglement, and Bell inequality.

Chem 8552. Quantum Mechanics II. (4 cr; Prereq–5551)

Chem 8561. Thermodynamics, Statistical Mechanics, and Reaction Dynamics I. (4 cr; Prereq–undergrad physical chem course)
Two-part sequence. Thermodynamics, equilibrium statistical mechanics, ensemble theory, partition functions. Applications, including ideal gases/crystals. Theories of simple liquids, Monte Carlo, and molecular dynamics simulations. Reaction dynamics from microscopic viewpoint.

Chem 8562. Thermodynamics, Statistical Mechanics, and Reaction Dynamics II. (4 cr; Prereq–8561)
Two-part sequence. Thermodynamics, equilibrium statistical mechanics, ensemble theory, partition functions. Applications, including ideal gases/crystals. Theories of simple liquids, Monte Carlo, and molecular dynamics simulations. Reaction dynamics from microscopic viewpoint.

Chem 8580. Special Topics in Physical Chemistry. (2-4 cr; max 4 cr) Prereq–Grad chem major or #
Topics (and availability) vary depending on instructor and development of the field.

Chem 8666. Doctoral Pre-Thesis Credits. (1-18 cr max 60 cr)
Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

Chem 8700. Advanced Concepts in Medicinal Chemistry: Combinatorial Methods in Medicinal Chemistry. (2 cr; A-F only, §Medic 8700, Pharm 6247H, Prereq–[2302 or equiv], [Bio 4331 or equiv])
Principles of current combinatorial methods for generation of biological/chemical libraries. Emphasizes utility in biology and in drug design. Material is drawn from primary literature.

Chem 8715. Physical Inorganic Chemistry. (4 cr; Prereq–[4001 or equiv] or grad chem major or #)
Physical methods and concepts applied to inorganic and organometallic systems, including many of the following methods: NMR, IR, UV-VIS, ESR, Mössbauer and mass spectroscopy, magnetic measurements, X-ray diffraction.

Chem 8725. Organometallic Chemistry. (4 cr; Prereq–4701 or equiv, grad chem major or #)
Synthesis, reactions, structures, and other important properties of main group and transition metal organometallic compounds; treatment in terms of modern electronic and structural theory; emphasis on their use as stoichiometric and homogeneous catalytic reagents in organic and inorganic systems.

Chem 8735. Bioinorganic Chemistry. (4 cr; Prereq–4701 or equiv, grad chem major or #)
Survey of role of metal ions in biology; emphasizes structure, function, and spectroscopy of metalloproteins and their synthetic analogs.

Chem 8745. Advanced Inorganic Chemistry. (4 cr; Chem 8715 or grad chem major or #)
Survey of topics in main group and transition metal chemistry; emphasizes synthesis, structure, physical properties, and chemical reactivity.

Chem 8777. Thesis Credits: Master’s. (1-18 cr; max 50 cr) Prereq–Max 18 cr per semester or summer; 10 cr total required (Plan A only)

For definitions of course numbers, abbreviations, and symbols, see page 167.
Courses

Chem 5780. Special Topics in Inorganic Chemistry. (2-4 cr. [max 4 cr.]; Prereq–Grad chem major or #) Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8880. Special Topics in Chemistry. (2-4 cr. [max 4 cr.]; Prereq–Grad chem major or #) Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8888. Thesis Credit: Doctoral. (1-24 cr. [max 100 cr.]; Prereq–Max 18 cr per semester or summer; 24 cr required)

Chicano Studies (Chic)
Department of Chicano Studies

College of Liberal Arts
Chic 5920. Topics in Chicano(a) Studies. (3 cr. Prereq–Sr or grad student) Multidisciplinary themes in Chicano studies. Issues of current interest.

Chic 5993. Directed Studies. (1-3 cr. [max 16 cr.]; Prereq.–#) Guided individual reading, research, and study for completion of the requirements for a senior paper or honors thesis.

Child and Adolescent Psychiatry (CAPy)
Department of Psychiatry

Medical School

CAPy 5624. Eating Disorders in Children and Adolescents: Medical and Psychological Perspectives. (1 cr; S-N only. Prereq–Upper div) Clinical characteristics of anorexia, bulimia nervosa in children/adolescents. Etiological factors, dimensional treatment approaches.

CAPy 5627. Workshop: Disruptive Behavioral Disorders II. (1 cr)

CAPy 5632. Workshop: Competence Enhancement Training Programs for Children with Disruptive Behavior. (1 cr)


CAPy 5634. Workshop: Developmental Dyslexia: Theory, Research, and Clinical Differentiation. (1 cr)


CAPy 5636. Workshop: Disruptive Behavioral Disorders III. (1 cr)

CAPy 5638. Workshop: Prevention Science II. (1 cr)

CAPy 5639. Workshop: Behavior Problems in Preschool Children. (1 cr)

CAPy 5641. Workshop: Prevention Science I—Risk Factors, Protective Factors, and Models of Disorder. (1 cr)


CAPy 5645. Workshop: Innovative Methods in Psychotherapy. (1 cr)

CAPy 5646. Workshop: Methods of Measurement and Assessment in Psychopathology. (1 cr)

CAPy 5647. Workshop: Prevention Science III. (1 cr) Behaviors/mechanisms related to peer rejection. Social skills interventions for promoting positive relationships and for building meaningful friendships.

CAPy 5648. Workshop: Prevention Science IV. (1 cr)

CAPy 5649. Workshop: Personality and Social Development. (3 cr)


CAPy 5664. Summer Practicum in Prevention Science II: Building Friendships and Peer Relationships Skills. (1 cr; A-F only. Prereq.–#) Behaviors/mechanisms related to peer rejection. Social skills interventions for promoting positive relationships and building meaningful friendships. Assignment worked out with instructor. Final exam.

CAPy 5660. ADHD Throughout the Life Span: Perspectives on Diagnosis, Assessment, and Developmental Course. (1 cr. §CAPy 5620, CAPy 5669) From its earliest presentation to its later adult manifestations. Clinical depression, diagnostic criteria. Disorders that commonly coexist with ADHD. Standard assessment procedures for making a diagnosis. Developmental changes in clinical procedures.


CAPy 5670. Preventing Violence and Antisocial Behavior in Children and Adolescents: Interventions, Practices. (1 cr. §CAPy 5662. Prereq–Community and school-based intervention programs aimed at the prevention of antisocial behavior are reviewed and evaluated) Community/school-based intervention programs aimed at preventing antisocial behavior.

Child Psychology (CPsy)
Institute of Child Development

College of Education and Human Development

CPsy 5413. Early Childhood and Public Policy. (3 cr) State, federal, and international policies and legislative activity touching first five years of a child’s life. Family, community, and institutional roles in promoting children’s social, cognitive, and emotional development. Issues related to health, mental health, poverty, developmental delays, and special needs.

CPsy 5414. Individualized Learning Experience in Early Childhood and Public Policy. (1-3 cr. [max 3 cr.]; Prereq.–Early Childhood Policy Certificate student, #) Individualized, applied learning experience. Focuses on early childhood policy development, research, or evaluation. Students attend an early childhood policy lecture series and participate in small discussion groups and follow-up activities.
Courses


CPsy 8304. Research Methods in Child Psychology. (3 cr. Prereq–Doctoral student or #) Review of principal research methods and designs in developmental psychology and consideration of special issues concerning research, including scientific integrity.

CPsy 8311. Seminar: History of Child Development. (2 cr; S-N only. Prereq–CPsy doctoral student or #) History of developmental psychology and child development movement in context of classic studies. Presentations by students/instructor.

CPsy 8321. Seminar: Current Issues in Teaching Developmental Psychology. (1 cr [max 2 cr]. Prereq–CPsy doctoral student or #) Problems/issues in teaching introductory child psychology.

CPsy 8933. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)


CPsy 8944. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)


CPsy 8966. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral])

CPsy 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Chinese (Chn)

Department of Asian Languages and Literatures

Chn 5011. Research Methods. (4 cr. Prereq–3032 or 3112) Introduction to the sources and approaches of research in language and literature.


Chn 5040. Readings in Chinese Texts. (2-4 cr [max 12 cr; A-F only. Prereq–3032 or equiv or #]) Students read a selection of various types to increase reading/speaking ability. Topics specified in Class Schedule.

Chn 5120. Topics in Chinese Linguistics. (4 cr [max 8 cr. Prereq–4121 or 4125]) Studies of the structure and change in the Chinese language.


Chn 5242. Chinese Classical Drama and Theatre. (4 cr [max 8 cr. Prereq–3032 or 3112]) A multimedia course on traditional Chinese theatre.

Chn 5250. Topics in Chinese Fiction. (4 cr [max 8 cr. Prereq–3032 or 3112]) Studies of traditional and modern Chinese fiction.

Chn 5260. Topics in Premodern Chinese Prose. (4 cr [max 8 cr]) Studies of representative Chinese prose writings of the pre-modern period.

Chn 5383. Directed Study. (1-5 cr [max 18 cr. Prereq–#]) Guided individual reading or study.


Chn 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

Chn 8430. Seminar in 20th-Century Chinese Literature. (4 cr. Prereq–#) In-depth study of life, time, and works of one major 20th-century author, or conceptualization and critical examination of one central issue that engaged the passion of 20th-century Chinese writers, as presented in their works.

Chn 8440. Seminar in Chinese Poetry and Poetics. (4 cr. Prereq–#) In-depth study of life, time, works, and poetic tradition of one major Chinese poet, or theory and development of one poetic genre.

Chn 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

Chn 8450. Seminar in Chinese Fiction and Narrative Theory. (4 cr; A-F only. Prereq–5105 or equiv or #) Important issues in Chinese narrative theory; complex relationship between development of Chinese fiction and that of Chinese narrative theory.

Chn 8494. Directed Research. (1-5 cr [max 16 cr]) Individual study/research with guidance of a faculty member.

Chn 8866. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral])

Chn 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr. Prereq–Max 18 cr per semester or summer; 24 cr required)

Civil Engineering (CE)

Department of Civil Engineering

Institute of Technology

CE 5094. Civil Engineering Research. (1-4 cr [max 4 cr. Prereq–#] Research or independent study in concrete, structural steel, soils, hydraulic, hydrology/municipal, environmental, or transportation problems. Investigations, reports, tests, designs.

CE 5170. Internet Based Study. (1-5 cr [max 15 cr]; A-F only. Prereq–Upper div IT) Internet based teaching with bi-weekly exercises on topic of concern.

CE 5180. Special Topics. (1-4 cr [max 4 cr; A-F only. Prereq–#) Topics vary depending on faculty and student interests.


CE 5214. Transportation Systems Analysis. (3 cr. Prereq–3201) Systems approach, its application to transportation engineering/planning. Prediction of flows and level of service. Production functions, cost optimization, utility theory, demand modeling, transportation network analysis, equilibrium assignment, decision analysis, multidimensional evaluation of transportation projects.


CE 5232. Advanced Portland Cement Concrete. (3 cr. Prereq–Upper div IT or grad, CE 4232 or #) Advanced topics in cement chemistry and selection of materials for and design of portland cement concrete mixtures. Lab assignments pertaining to mixture design and short-term and long-term behavior. Use of admixtures and fiber reinforcement. Effects of proportioning of standard materials.

CE 5233. Advanced Bituminous Materials. (3 cr. Prereq–Upper div IT or grad, CE 3402 or #) Advanced topics in selection and design of bituminous materials. Asphalt cement, rheology, emulsions, chip seals, hot-mix asphalt design, viscoelastic characterization. Lab assignments pertaining to rheology, mixture design and viscoelastic behavior.

CE 5311. Experimental Geomechanics. (3 cr; A-F only. Ge 3031, Prereq–Upper div IT or grad, 4301. Ge 3401 or #) Machine stiffness, closed-loop testing, small-strain theory. Measurement of deformation: strain gages, LVDTs, accelerometers, and associated circuits. Direct and indirect testing. Material behavior: experiments on anisotropic, damaged, and fluid-filled solids.

For definitions of course numbers, abbreviations, and symbols, see page 167.
Courses

CE 5321. Geomechanics. (3 cr; A-F only. §GeoE 5321. Prereq—Upper div IT or grad, 4301 or GeoE 4301) Elastostatics and elastic solution for non-linear boundary value problems. Wave propagation in bounded elastic media. Elements of fracture mechanics and applications. Elements of poroelasticity and applications.

CE 5331. Geomechanics Modeling. (3 cr; A-F only. §GeoE 5331. Prereq—Upper div IT or grad, 4301 or #) Soil and rock response in triaxial testing; drained and undrained behavior; elastic and plastic properties. Modeling stresses, strains, and failure in geomechanics problems.

CE 5341. Wave Methods for Nondestructive Testing. (4 cr; A-F only. Prereq—[AE 2021, AEM 3031 or #] Introduction to contemporary methods for nondestructive characterization of objects of civil infrastructure (e.g., highways, bridges, geological sites). Imaging technologies based on propagation of elastic waves such as ultrasonic/resonant frequency methods, seismic surveys, and acoustic emission monitoring. Lecture, lab.

CE 5351. Advanced Mathematics for Civil Engineers. (3 cr; A-F only. Prereq—[Math 2263 or Math 2374 or equiv], [or grad student] in civil engineering] or #) Emphasizes skills relevant for civil engineers. Mathematical principles explained in an engineering setting. Applications from various areas in civil engineering.

CE 5411. Applied Structural Mechanics. (3 cr; A-F only. Prereq—[Grad of at least C- in 4401, upper div IT or grad student] or #) Primary stresses and failure criteria in 3 dimensions. Introduction to plane elasticity, energy methods, torsion of beams, and bending of unsymmetrical beams.

CE 5412. Prestressed Concrete Design. (3 cr; A-F only. Prereq—[Grad of at least C- in 4401] or [upper div IT or grad student] or #; 4412 recommended) Design of prestressed concrete structures. Time dependent effects, behavior, flexure, shear, torsion, deflections, continuous systems.

CE 5413. Masonry Structures. (3 cr; A-F only. Prereq—[Grad of at least C- in 3401, upper div IT or grad student] or #; 4401 recommended) Masonry materials and their production. Mortars, grouts. Design of unreinforced, reinforced, and prestressed masonry structural systems. Walls, columns, lintels, arches. Codes/specifications, testing, inspection.


CE 5551. Environmental Microbiology Laboratory. (4 cr; A-F only. Prereq—2501, upper div or grad student) Role of microorganisms in environmental bioremediation, pollution control, water/wastewater treatment, biogeochemistry, and human health. Basic microbiological techniques: isolation, identification, enumeration of bacteria, biodeterioration kinetics, disinfection. Lecture, lab.

CE 5581. Water Resources: Individuals and Institutions. (3 cr; A-F only) Control of water resources by natural system functions, user actions, and influence of social, economic, and political institutions. Water resource policy in the United States. Case studies (e.g., flood/drought management).

CE 5591. Environmental Law for Engineers. (3 cr; A-F only. Prereq—[upper div IT] or grad student) Environmental regulatory law relevant to civil and environmental engineering; specific provisions of federal statutory and regulatory laws such as NEPA, CWA, RCRA, CAA, and CERCLA.

CE 8022. Numerical Methods for Free and Moving Boundary Problems. (3 cr; A-F only. Prereq—5401 or #) Examples of free and moving boundary problems: metal solidification, filling, polymer molding, flow in porous media, ground freezing. Solutions: analytical, fixed finite difference, fixed finite element, front tracking schemes, general deforming finite element methods.

CE 8094. Civil Engineering Research. (1-4 cr [max 12 cr]; #) Research or independent study in concrete, structural steel, soils, hydraulics, hydrology, and municipal, environmental, or transportation problems. Investigations, reports, tests, or designs.

CE 8200. Seminar: Transportation. (1 cr or [max 3 cr]; S-N only) Content depends on instructor and student. Sample topics: traffic safety, traffic flow theory, transportation materials, transportation planning, transportation economics.


CE 8212. Advanced Travel Demand Modeling and Supply Analysis. (3 cr. Prereq—5211 or equiv, Stat 3021) Application of random utility theory to model travel demand; deterministic and stochastic trip assignment; network design problems; transportation planning, software.

CE 8213. Advanced Transportation Technologies Seminar. (1 cr; S-N only. §ME 8772) Advanced technologies specifically related to transportation. Topics drawn from core science/technology areas of human factors, intelligent vehicles, traffic modeling, management, sensing, communications, and controls.

CE 8214. Transportation Economics. (3 cr; A-F only) Application of microeconomic theory to transportation. Demand/demand estimation, cost/cost estimation, pricing/ investment, regulation/ deregulation. Urban/intercity vehicle transportation, freight transportation.

CE 8215. Stochastic Transportation Modeling. (3 cr. Prereq—[8210 or 8211, Stat 5201 or equiv]) Random variables and estimation, time-series models, linear systems and Kalman filtering; discrete-time Markov processes and dynamic travel demand models; continuous-time Markov processes and traffic flow.

CE 8216. Urban Traffic Operations. (3 cr) Capacity analysis techniques for urban streets, optimal traffic signal timing, coordination, real time control. Traffic signal hardware, including detectors/controllers. Operational techniques for traffic management. Use of computer program packages in traffic engineering practice. Freeway operations/ control.

CE 8231. Advanced Pavement Engineering. (3 cr. Prereq—[4231 or #]) Advanced concepts in pavement analysis and design; computation of stresses and strains in flexible and rigid pavement systems; review of Boussinesq theory, Burmester model, and Westergaard model; load transfer in rigid pavements; temperature induced stresses; mechanics of trafficking.

CE 8233. Advanced Bituminous Materials Characterization. (3 cr. Prereq—[4302, grad student] or # Applications of viscoelasticity, rheology, elastoplasticity, and fracture mechanics to bituminous materials characterization. Lectures, discussions of advanced research reading assignments, laboratory assignments.

CE 8300. Seminar: Geomechanics. (1-3 cr [max 4 cr]; S-N only §GeoE 8300) Presentations on various topics.


CE 8311. Advanced Rock Mechanics. (3 cr; A-F only. §GeoE 8311. Prereq—IT grad student, 4301 or GeoE 4301 or #) Stress transformations; principal stresses and directions. Friction and behavior of rock joints; stability of frictional sliding. Elastic waves; acoustic emission and seismic measurements. Fragmentation and rock breakage.


CE 8322. Storage and Flow of Granular Materials. (3 cr; A-F only. §GeoE 8322. Prereq—IT grad student, 4301 or #) Plasticity of granular media. Static and dynamic method of slices. Storage and flow of granular materials in bins and hoppers. Stress concentrations, arching, piping. Experiments on granular material properties and flow.


CE 8333. FTE: Master’s. (1 cr. Prereq—Master’s student, adviser and DGS consent)


CE 8337. Boundary Element Methods II. (3 cr; A-F only. §GeoE 8337. Prereq—4336, exp 5336 or #) Transient and nonlinear problems.

Courses

CE 8351. Advanced Groundwater Mechanics I. (3 cr; A-F only. §GeoE 8351. Prereq–4351 or GeoE 4351, IT grad student or #) Solute transport; shallow flow in leaky aquifers; complex variable methods in groundwater flow. Analytical solution methods: potentials for line sinks, line doublets, line dipoles, area sinks, and special analytic elements; singular Cauchy integrals; analytic elements in domains with closed boundaries.

CE 8352. Advanced Groundwater Mechanics II. (3 cr; A-F only. §GeoE 8352. Prereq–4351, IT grad student or #) Applying complex methods, including conformal mapping, in groundwater mechanics; solving problems with free boundaries using the hodograph method; drains in aquifers with free boundaries; superposition of solutions with drains; singular Cauchy integrals; boundary elements.

CE 8361. Engineering Model Fitting. (3 cr; A-F only. §GeoE 8361. Prereq–IT grad student or #) Parameter estimation and inverse modeling for civil and geological engineering. Formulating engineering model fitting problems; comparing and selecting various fit criteria; implementing numerical algorithms; analyzing and interpreting results using both statistical and qualitative tools; designing future measurement plans.

CE 8400. Seminar. Structures. (1 cr; max 3 cr; S-N only) Content depends on instructor and student. Sample topics: theory of elasticity, optimization, reliability, wave propagation, soil dynamics, experimental equipment, wind forces on structures, structural failures, modern construction practices.

CE 8401. Fundamentals of Finite Element Method. (3 cr; A-F only. Prereq–4411 or #) Elements of calculus of variations; weak and strong formulations; linear and structural problems. Isoparametric elements and numerical integration. Basic concepts of error analysis and convergence. Analysis of plates and shells. Introduction to mixed methods and time dependent problems.


CE 8412. Shell Structures. (3 cr; A-F only. Prereq–IT grad or #) Static analysis of thin elastic shells based on Love’s postulates. Membrane and bending theories. Thermal stresses in cylinders. Buckling of shells of revolution. Offered alternate years.


CE 8422. Earthquake Engineering. (3 cr; A-F only. Prereq–8421 or #) Introduction to earthquake engineering; response spectra; energy absorption capacity of structures; estimation of damping; earthquake resistant design; seismic design codes; base isolation; soil-structure interaction. Blast resistant design. Wind effects on structures.

CE 8431. Structural Stability. (3 cr; A-F only. Prereq–IT grad student or #) Classification of discrete/continuous conservative/ nonconservative systems. Buckling analysis of, e.g., structural members, frameworks, and plates by classical/numerical methods. Offered alternate years.

CE 8432. Analysis of Thin-Walled Members. (3 cr; A-F only. Prereq–5411 or #; offered alt yrs) Analysis of thin-walled structural members based on Vlasov theory and its modifications. Members with open and closed cross sections. Second-order effects and buckling. Influence of inelastic material behavior on buckling.

CE 8441. Plastic Design of Steel Structures. (3 cr; A-F only. Prereq–4411 or #; offered alt yrs) Plastic analysis and design of structures with applications to grillages, continuous beams, portal and gable frames. Collapse mechanisms and plastic deformations. Minimum weight design.

CE 8442. Nonlinear Analysis of Structural Systems. (3 cr; A-F only. Prereq–4411, 4413 or #; offered alt yrs) Advanced theory and computational techniques for analyzing complex structural building systems. Using comprehensive geometric and material nonlinear analysis for designing steel and composite structures.

CE 8443. Fatigue and Fracture of Steel Structures. (3 cr; A-F only. Prereq–4401 or #; offered alternate years) Fracture mechanics and ferrous metallurgy, welding, S-N curves of steel structures. Emphasizes design/materials selection, evaluation, and repair of existing structures. Case studies such as fracture of steel structures during earthquakes, fatigue of large vehicle frames, and fatigue of bridge structures.

CE 8444. FTE. Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

CE 8451. Behavior of Reinforced Concrete Structures. (3 cr; A-F only. Prereq–4412 or #) Advanced topics; experimental and theoretical background to design rules and provisions. Moment-curvature analysis of members. Shear; torsion; disturbed regions. Beam column joints; shear walls. Effects of earthquake loading. Limit analysis.


CE 8490. Special Topics. (1-3 cr; max 3 cr; A-F only. Prereq–#) Topics vary depending on faculty and student interests.

CE 8500. Environmental Seminar. (1 cr; max 3 cr; S-N only. Prereq–Grad CE major or #) Broad coverage of topics in environmental engineering and science. Speakers consist primarily of graduate students in these areas, but presentations may also be given by University faculty and guest speakers.


CE 8502. Environmental Fluid Mechanics II. (4 cr; A-F only. Prereq–8501 or #) Reynolds equations. Developed and developing turbulent boundary layers and slender flows, and their interaction with inviscid flow. Jets, plumes, wakes and shear layers. Statistical description of turbulence; data analysis.

CE 8503. Environmental Mass Transport. (4 cr; A-F only. Prereq–3502, 3501 or equiv or #) Principles of intraphase and interfacial chemical transport and fate in the environment, specifically the processes of diffusion, dispersion, and convection. Application to surface water and estuarine mixing, dispersion in groundwater, and transport between these media.

CE 8504. Theory of Unit Operations. (4 cr; A-F only. Prereq–4541, 4531) Theoretical basis, design, and operation of chemical and physical processes used in treating and controlling water quality, including adsorption, ion exchange, sedimentation, thickening, filtration, gas transfer, coagulation, flocculation, membrane processes, and desalination.

CE 8505. Biological Processes. (3 cr; A-F only. Prereq–4502, 4501 or #) Theoretical principles underlying chemical and biological wastewater treatment processes, including aerobic and anaerobic treatment for organic carbon and nutrient removal. Mathematical models of microbial growth kinetics and mass transport in suspended growth and attached film applications are developed.

CE 8506. Stochastic Hydrology. (4 cr; A-F only. Prereq–Stat 3201 or equiv or #) Analysis and synthesis of hydrologic series and systems; derived distributions; uncertainty and risk analysis; flood frequency analysis; multivariate time series analysis; correlation analysis; series of long-range dependence; linear estimation; geostatistics; sampling networks; hydrologic forecasting.


CE 8508. Ecofluid Dynamics. (4 cr; A-F only. Prereq–3502 or equiv or #) Theoretical principles underlying environmental fluid dynamics of biochemical processes in lakes, rivers, wetlands, coastal ocean. Emphasizes small-scale fluid motion, dominant flux path, growth kinetics, thin layers, microstructure measurements.


CE 8521. The Atmospheric Boundary Layer. (4 cr; A-F only. Prereq–IT or COAFES grad student or #) Land-atmosphere interactions and turbulent transport in the atmospheric boundary layer (ABL), the lowest part of the atmosphere. ABL development and dynamics. Turbulence, surface energy balance, spectral analysis, similarity theory. Flow over homogeneous and heterogeneous surfaces. Atmospheric stability, measurement, simulation of turbulent fluxes.

CE 8541. Aquatic Chemistry. (3 cr; A-F only. Prereq–4541 or #) Advanced course on water chemistry; physical chemical principles and geochemical processes controlling the chemical composition of natural waters, soil- and sediment-water interactions. Emphasizes behavior of inorganic contaminants in natural waters and engineered systems and dissolved and particulate matter.

For definitions of course numbers, abbreviations, and symbols, see page 167.
Courses

CE 8542. Chemistry of Organic Pollutants in Environmental Systems. (3 cr; AF only) §WRS 3542, ANE 3542, ANE 5542, CNES 3542, CNES 5542. Prereq—AF 3501 or AF 5501 or AF 3541 or AF 5541 or AF 3541. Principles of environmental engineering for contaminants of aquatic systems. Emphasizes PCBs, PAHs, dioxins, insecticides, herbicides, and chlorinated solvents. Factors affecting their transport/transformation. Structure- and property-activity relationships, their use in predicting organic chemical behavior.

CE 8551. Environmental Microbiology: Molecular Theory and Methods. (4 cr; AF only) §WRS 3551, ANE 3551, ANE 5551, CNES 3551, CNES 5551. Introductory microbiology, molecular genetics, and molecular phylogeny. Application of nucleic-acid techniques in environmental microbiology and microbial ecology.

CE 8552. Groundwater Microbiology: Laboratory. (4 cr; AF only) Prereq—Grad CE major or #. Exposure to basic environ eng and microbiol.


CE 8562. Analysis and Modeling of Aquatic Environments II. (3 cr or 6 cr. Prereq—One sem grad work or #) Models for transport/transformation of pollutants, nutrients, particulates, ecosystems, etc., from recently completed theses, articles, or research in progress. Students review assigned recent papers, make presentations, and analyze a topic of their choice.

CE 8563. Industrial Waste Treatment. (3 cr; AF only. Prereq—CE 8571) Prereq—Grad CE major or #. Exposure to basic environ eng and microbiol.

CE 8571. Hydraulic Measurements. (3 cr; AF only. Prereq—CE 3520 or #) Lab and field methods and instruments for measuring hydraulic pressure, velocity, and discharge.

CE 8572. Computational Environmental Fluid Dynamics. (4 cr; AF only. Prereq—Grad student in IT or COAPES or #) Finite difference methods, their application to solution of one-/two-dimensional problems in environmental fluid dynamics. Stability, convergence, consistency, and accuracy of numerical schemes. Navier-Stokes equations, their physical meaning, and their numerical solution. Turbulence modeling: RANS and LES.

CE 8581. Research and Professional Ethics in Water Resources andEnvironmental Science. (5 cr; S-N only. §WRS 3581, ANE 3581, CNES 3581, CNES 5581) Prereq—AF 3501 or AF 3541 or AF 5501 or AF 5541 or AF 3501 or AF 5501 or AF 5541. Ethics of water resources science and environmental engineering research/practice. Societal responsibility, plagiarism, research ethics, authorship, confidentiality, conflicts of interest, professional relationships, fraud, reporting misconduct. Meets during first eight weeks of spring semester.

CE 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral) §WRS 3666, ANE 3666. Prereq—Max 18 cr per semester or summer; 10 or total required (Plan A only)

CE 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 or total required (Plan A only)

CE 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 or required)

Classical and Near Eastern Studies (CNES)

College of Liberal Arts

CNES 5013. Introduction to Roman Law. (3 cr) Survey of Roman law from social and historical perspectives. Basic concepts of Roman private law and legal procedure.


CNES 5070. Topics in Ancient Religion. (3 cr. Max 18 cr) §RelA 5070. Prereq—RelA 3071 or 3072 or 3073 or 3074 or any ReLS course or #) Study of a specific aspect of religion in Classical and Near Eastern antiquity such as healing cults, magic and divination, Gnosticism, or prophecy and authority. Topics specified in Class Schedule.

CNES 5071. Greek and Hellenistic Religions. (3 cr. §CNES 3071, RelA 3071. Prereq—§) Greek religion from the Bronze Age to Hellenistic times. Sources include literature, art, and archaeology. Homer and Olympian deities; ritual performance; prayer and sacrifice; temple architecture; death and the afterlife; mystery cults; philosophical religion; Near Eastern salvation religions. Meets with 3071.


CNES 5080. New Testament Proseminar. (3 cr. Max 18 cr) §RelA 5080. Prereq—RelA 1082 or 3072 or equiv) Study of some specific aspect of the New Testament and related literature. The class is organized as a discussion seminar. Topics specified in Class Schedule.


CNES 5083. Ancient Comedy. (3 cr) Greek/Roman comic drama (e.g., Aristophanes, Menander, Plautus, Terence).

CNES 5103. Hellenistic and Early Roman Art and Archaeology. (3 cr. §CNES 3103. Prereq—RelA 3008 or #) Sculpture, architecture, painting, and topography in developing centers of Hellenistic culture in eastern Mediterranean and in Etruscan and Roman towns, from 400 B.C. to the beginnings of the Roman Empire.

CNES 5108. Greek Architecture. (3 cr. §ArtH 5108. Prereq—Jr, ArtH 3108) Geometric through classical examples of religious and secular architecture and their setting at archaeological sites in Greece, Asia Minor and Italy.

CNES 5111. Prehistoric Art and Archaeology of Greece. (3 cr. §ArtH 5111. Prereq—Jr, ArtH 3111) Artistic and architectural forms of Neolithic period in Aegean area and Cycladic, Minoan, and Mycenaean cultures. Arts and methods of modern field archaeology; the record of human habitation in the Aegean area. Archaeological evidence as a basis for historical reconstruction.

CNES 5112. Archaiac and Classical Greek Art. (3 cr. Prereq—Jr, Class/Ath 3112) Sculpture, painting, architecture and minor arts in Greek lands from the 9th through 5th centuries B.C. Examination of material remains of Greek culture; archaeological problems such as identifying and dating buildings; analysis of methods and techniques. Emphasis on Periklean Athens.

CNES 5120. Field Research in Archaeology. (3-6 cr [max 6 cr. §ArtH 5120, CLCV 5120. Prereq—•]) Field excavation, survey, and research at archaeological sites in the Mediterranean area. Emphasis on excavation and exploration; interpretation of archaeological materials.

CNES 5172. House, Villa, Tomb: Roman Art in the Private Sphere. (3 cr. §ArtH 5172. Prereq—Intro art history course or #) Architecture, painting, and sculpture of urban houses, country estates, and tombs in Roman world. Relationships between public/private spheres and literary/physical evidence. Usefulness of physical evidence in illuminating gender roles.

CNES 5182. Art and the State: Public Art in the Roman Empire. (3 cr. §ArtH 5182, CLCV 5182. Prereq—Intro art history course or #) Origins of Roman public art. Use in maintaining community. Exploitation by first emperor, Augustus. Development/diffusion through later empire. Varying capabilities to adjust to demands of a Christian Empire.

CNES 5251. Archaeology of Herodian Israel. (3 cr; AF only, §RelA 5251, RelS 5251) Prereq—One course in [archaeology or ancient history] or grad student) Archaeological sites in Israel dating to era of Herod the Great (37-4 B.C.). Palaces and religious edifices. Remains from Jewish/gentile settlements throughout the kingdom. Course readings consist of contemporary literary sources and excavation reports.

CNES 5252. History of Early Christian Art in Context. (4 cr. §ArtH 5252, CLCV 5252. Prereq—Intro art history course or #) Role played by art in formation of early Christian/Byzantine communities and in establishing their relationships with pagan world and early Islam.

CNES 5340. Practicum in Archaeological Field and Computer Techniques. (3 cr. §ArtH 3340, ArtH 5340, CLCV 3340, CLCV 5340. Prereq—Grad or major or ancient art and archaeology course or #) Methods used for excavation of Old and New World sites. Meets at archaeometry/computer lab for part of the semester and at a selection in Minnesota for day-long sessions for 9 to 10 weeks. Meets with 3340. Exception: 1 cr.

CNES 5502. Ancient Israel: From Conquest to Exile. (3 cr. §CNES 3502, Hist 3502, RelA 3502. Prereq—Knowledge of Hebrew not required; 5501 recommended) Israeliite history in context of what is known from Egyptian, Canaanite, and Near Eastern sources. Focuses on issues raised by archaeological data related to Israelite conquest of Canaan.

Clinical Laboratory Science (CLS)

Department of Laboratory Medicine and Pathology

Medical School

CLS 5064. Introduction to Clinical Immunohematology. (2 cr; A-F only. §MedT 4064. Prereq–#) Principles of blood grouping, antibody identification, compatibility testing, serology, and immunology.

CLS 5065. Introduction to Clinical Immunohematology: Laboratory. (2 cr; A-F only. §MedT 4065. Prereq–#) Exercises illustrating techniques in blood grouping, antibody identification, compatibility testing, and detection of antibodies by serological and immunological methods.

CLS 5090. Special Laboratory Methods. (1-2 cr [max 2 cr]; A-F only. §MedT 4090. Prereq–#) Assignment on an individual basis to one of a variety of special areas of experience in the clinical lab.

CLS 5100. Virology, Mycology, and Parasitology for Medical Technologists. (2 cr; A-F only. §MedT 4100. Prereq–Microbiology course with lab, biochemistry course) Lab diagnosis of viral, fungal, and parasitic infections. Lecture.


CLS 5105. Principles of Diagnostic Microbiology: Laboratory. (2 cr; A-F only. §MedT 4105. Prereq–One microbiology course with lab, one biochemistry course. #) Current techniques used in lab diagnosis of infectious disease. Isolating/identifying bacteria/yeasts. Antimicrobial testing. Laboratory.

CLS 5120. Seminar: Clinical Laboratory Science. (1 cr [max 3 cr]; S-N only. Prereq–#) Current literature. Presentation/discussion of research.

CLS 5121. Journal Presentations. (1 cr [max 2 cr]; S-N only. Prereq–1st yr CLS grad student) Critical analysis, evaluation, discussion of current journal articles in student's specialty area.

CLS 5125. Practicum Teaching. (1-2 cr [max 2 cr]; A-F only. Prereq–#) Supervised teaching experience, develop skills using instructional materials, tests, and measurements.

CLS 5127. Introduction to Management and Education I. (1 cr; A-F only. §MedT 4127W. Prereq–#) Supervised experience and assignment of specific problems related to lab service and management in health care institutions.

CLS 5135. Advanced Clinical Microbiology. (3 cr; A-F only. Prereq–#) Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5140. Techniques for Teaching. (2 cr; A-F only. Prereq–#) Developing objectives, classroom activities, and evaluation criteria for medical technology education.

CLS 5155. Advanced Clinical Hematology. (3 cr; A-F only. Prereq–#) Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5165. Advanced Clinical Immunohematology. (3 cr; A-F only. Prereq–#) Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5175. Advanced Clinical Chemistry. (3 cr; A-F only. Prereq–#) Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5251. Hematology I: Basic Techniques. (3 cr; A-F only. §MedT 4251. Prereq–#) Theory and application of basic principles and techniques in clinical hematology and hemostasis. Lecture and lab.

CLS 5252. Hematology II: Morphology and Correlation. (2 cr; A-F only. §MedT 4252. Prereq–§251 or MedT 4251) Fundamentals of blood and bone marrow examination emphasizing microscopic identification of immature and abnormal cells. Clinical correlation of lab findings in hematology and hemostasis. Lecture and lab.

CLS 5253. Hemostasis. (1 cr; A-F only. §MedT 4253. Prereq–§251 or MedT 4251) Theory and application of specific concepts and techniques in hemostasis and coagulation. Lecture and lab.


CLS 5311. Clinical Chemistry I: Laboratory Applications. (2 cr; A-F only. §MedT 4311. Prereq–One organic chemistry course with laboratory; one biochemistry course. #) Application of clinical chemistry principles and laboratory techniques in the analysis of urine, plasma, and body fluids. Emphasis on laboratory tests to evaluate renal function, electrolytes, and acid-base balance. Introduction to principles and processes for managing test quality. Laboratory.

CLS 5320. Clinical Chemistry II: Lecture. (2 cr; A-F only. §MedT 4320. Prereq–Organic chem course with lab, biochemistry course, 5310 or MedT 4310, #) Principles and theory of clinical chemistry for assessing metabolic disease/dysfunction involving hormones, enzymes, lipids/lipoproteins, cardiac function, liver, and digestive tracts. Emphasis on measurement methods and physiological significance.

CLS 5321. Clinical Chemistry II: Laboratory Applications. (2 cr; A-F only. §MedT 4321. Prereq–organ chem course with lab, biochemistry course, 5310 or MedT 4310, #) Application of clinical chemistry principles and lab techniques in analyzing serum, plasma, and urine. Focus on tests to evaluate selected disorders. Developing lab and instrumentation use skills with emphasis on quality control and technique.

CLS 5768. Advanced Hematology. (5-10 cr [max 30 cr]; A-F only. Prereq–#) Practical experience collecting bone marrow from patients. Diagnosing hematological diseases by evaluating and interpreting cells from clinical specimens of bone marrow, peripheral blood, and, if applicable, lymph nodes.

CLS 5864. Research Seminar. (1 cr [max 10 cr]; S-N only. Prereq–#) Departmental research seminar series.

CLS 5865. Departmental Seminar. (1 cr [max 10 cr]; S-N only. Prereq–#) Departmental clinical lab research seminar series.

CLS 8193. Advanced Topics in Clinical Chemistry. (2 cr. Prereq–#) Includes use of molecular approaches to diagnosis and risk assessment of selected diseases.

CLS 8194. Research on Clinical Laboratory Problems. (1-3 cr [max 3 cr]. Prereq–#) Individual research project in a selected area.

CLS 8293. Educational Administration in Medical Technology. (2 cr. Prereq–#) Responsibilities of administration to students, faculty, and educational community. Curriculum planning, accreditation, staffing, student selection, finances. Sample administrative problems and decisions used as practice vehicles.

CLS 8333. FTE: Master's. (1 cr. Prereq–Master's student, adviser and DGS consent)
Courses

Cognitive Science (CgSc)

College of Liberal Arts

CgSc 8000. Seminar: Philosophy of the Cognitive Sciences. (3 cr) [max 6 cr] PHIL 8840. Prereq—Grad cog sci minor or #. Philosophical framework for analyzing cognitive sciences. Recent developments in metaphysics and epistemology. Nature of scientific theories, methodologies of cognitive sciences, relations among cognitive sciences, relation of cognitive science to epistemology and various philosophical problems.

CgSc 8001. Proseminar in Cognitive Science. (2 cr; S-N only. Prereq—Grad cog sci minor or #) Survey of major topics, including theoretical assumptions, methods, and samples of current research.

CgSc 8360. Seminar: Topics in Cognitive Science. (1-3 cr [max 6 cr]. Prereq—Grad cog sci minor or #) Lectures and in-depth discussion on a topic.

Communication Studies (Comm)

Department of Communication Studies

College of Liberal Arts

Comm 5110. Special Topics in Communication Theory. (3 cr [max 6 cr]) Advanced theoretical problems. See department office for current offering.


Comm 5233. Electronic Media and National Development. (3 cr) Use of electronic media to change social, political, economic, and cultural life. Use by developing nations to improve agricultural practices, hygiene standards, literacy, and awareness of civic responsibility.

Comm 5261. Communicative Processes in Electronic Media. (3 cr. Prereq—5261 or #) Organizational practices of media communicators. Media content as link between communicators and audiences. How viewers use/process media content.

Comm 5401. Advanced Theories of Communication. (3 cr. Prereq—5401 or grad) Survey of major theoretical approaches to communication including, positivism, constructivism, and systems.

Comm 5402. Advanced Interpersonal Communication. (3 cr. Prereq—5401 or 5302) Social scientific approaches to interpersonal communication. Theory, research findings.


Comm 5406. Communication and Gender. (3 cr. Prereq—One woman’s studies course, #) How gender affects verbal communication. Development of analytical skills through readings, exercises, research that raise awareness of the power of language and the influence of gender prescriptions. Comparisons across languages where possible.


Comm 5411. Small Group Communication Research. (3 cr; A-F only. Prereq—Comm 5411 or #) Survey of small group communication research: theory and practice. Group decision-making and leadership.

Comm 5421. Quantitative Methods in Communication Research. (3 cr; A-F only. Prereq—Comm 5401 or #) Social scientific methods used in studying human communication. Optional data processing laboratory for additional credit.

Comm 5431. The Process of Persuasion. (3 cr. Prereq—5431) Communication campaigns (e.g., advertising, political) illustrating persuasive processes and theories. Research paper required.

Comm 5441. Communication in Human Organizations. (3 cr. Prereq—9 cr social science, 3441 or #) Communication in organizational settings. Organizational structure and dynamics and their effect upon the communication process. Individual projects.

Comm 5451. Intercultural Communication Processes. (3 cr) Theory and research on cultural differences in values, norms, behaviors, and perceptions that affect communication across cultures internationally and domestically.

Comm 5461. Conversation Analysis. (3 cr. [ offerings: Ling 5461. Prereq—Ling 3001 or Ling 5001]) Discourse processes in dyadic and multiparty conversation. Application of concepts through analysis of conversations.

Comm 5462. Field Research in Spoken Language. (3 cr. §Ling 5462. Prereq—Ling 5461, Ling 3001 or Ling 5001) Transcribing and analyzing verbal communication and movement related to it. Applying concepts to recorded conversations.

Comm 5611. Survey of Rhetorical Theory. (3 cr. Prereq—1101) Survey of rhetorical theory from ancient to contemporary period; application of theory to public discourse.

Comm 5615. Introduction to Rhetorical Criticism. (3 cr. Prereq—1101; 3601 recommended) Analysis of public discourse using various theoretical perspectives.

Comm 5617. History and Criticism of U.S. Public Discourse: 1630-1865. (3 cr. Prereq—Jr) How discourse has been used to establish or maintain power. Speeches and public debates used to examine American public address from 17th century (e.g., Puritan sermons) to the Civil War.

Comm 5618. History and Criticism of U.S. Public Discourse: 1865-1950. (3 cr. Prereq—Jr) How discourse has been used to establish or maintain power. Speeches and public debates used to examine U.S. public address from the mid 19th century to 1950.

Comm 5970. Directed Study. (1-3 cr; max 6 cr; S-N only. Prereq—Nine 3xxx-5xxx Spch cr, #) Guided individual reading or study.

Comm 5994. Communication Research Practicum. (1-3 cr [max 9 cr]; S-N only. Prereq—#) Students participate in research group.

Comm 8110. Seminar: Advanced Speech Problems. (3 cr [max 15 cr. Prereq—Undergrad degree in spch-comm or equiv]) Evaluation of research methods in speech-communication.

Comm 8210. Seminar: Selected Topics in U.S. Electronic Media. (3 cr [max 6 cr. Prereq—5210 or #; offered when feasible]) Literature survey; evaluating research on topics; conducting independent research project on a particular topic.


Comm 8333. FTE: Master’s. (1 cr. Prereq—Master’s student, adviser and DGS consent)

Comm 8402. Seminar: Interpersonal Communication. (3 cr. Prereq—5402 or #) Evaluate and develop new perspectives for analyzing, diagnosing, and managing interpersonal communication problems.


Comm 8406. Seminar: Language and Gender Research. (3 cr. Prereq—5406) Readings and research on current issues. Data collected to test hypotheses and apply theory.


Comm 8444. FTE: Doctoral. (1 cr. Prereq—Doctoral student, adviser and DGS consent)


Comm 8452. Seminar: Methods of Intercultural/Diversity Facilitation. (3 cr. Prereq—4451 or 5452 recommended) Theories of and techniques for managing effective intercultural communication and diversity. Intercultural training.

Comm 8502. Seminar: Communication Theory Construction. (3 cr. Prereq—5421 or #) Logic of communication theory development and modification from a social scientific perspective. Types of communication theories.

Comm 8503. Historical and Descriptive Research in Speech-Communication. (3 cr) Elements involved in conducting and analyzing historical and descriptive research; approaches to historical research, assessing primary and secondary sources; completing a major research project.

Comm 8504. Seminar: Rhetorical Criticism. (3 cr. Prereq—5615 or #) Rhetoric criticism theories and methods. Rhetoric as applied to literary studies and the growth of hermeneutics as vantage points for reassessing rhetorical methods.

Comm 8506. Seminar: Rhetorical Analysis of Campaigns and Movements. (3 cr. Prereq—5431, 5617 or 5618, 10 cr soc sci or #) Literature and methodology in historical and contemporary rhetorical campaigns and movements.


Comm 8625. Seminar: Communication Ethics. (3 cr; A-F only. Prereq—Ethics course or #) Independent research on communication ethics in interpersonal, group, organizational, intercultural, and media settings. Theories of ethics and methods of analysis.

Comm 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 18 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)
Courses

Comparative and Molecular Biosciences (CMB)

**College of Veterinary Medicine**

CMB 5180. Ecology of Infectious Diseases. (3 cr; §PubH 6180. Prereq–[MVB or WMed] grad student or #) Ways in which host, agent, and environmental interactions influence transmission of infectious agents. Environmental dissemination, eradication/con- control, evolution of virulence, analytical/molecular tools.

CMB 5200. Statistical Genetics and Genomics. (4 cr; A-F only §AnSc 5200) Statistical issues in genomics. Gene detection, including statistical analysis/designs for linkage study and for mapping quantitative trait loci. Linkage analysis using pedigree data for codominant/dominant markers. Using radiation hybrid mapping and single cell typing. Design issues in linkage analysis, parentage testing, and marker polymorphism.

CMB 5594. Directed Research in Molecular Veterinary Biosciences. (1-4 cr [max 4 cr]; A-F only. Prereq–#) Special project, adding specific content to clinical science, under guidance of faculty member.

CMB 8100. Research Rotation in Molecular Veterinary Biosciences. (4 cr [max 8 cr]; A-F only. Prereq–1st yr MVB grad student) Directed research laboratory rotations. Experimentation, supplemental reading, research presentations under guidance of faculty member who is potential thesis adviser. Taught by program faculty.

CMB 8134. Ethical Conduct of Animal Research. (2 cr; A-F only. Prereq–[Grad or professional school] student or #) Ethical considerations in the use of animal subjects in agricultural, veterinary, and biomedical research. Federal, state, and University guidelines relating to proper conduct for acquisition/use of animals for laboratory observation, epidemiological, and clinical research. Regulatory requirements. Bases for proper conduct. Societal impact on scientific investigations utilizing animal subjects.


CMB 8202. Mechanisms of Animal Health and Disease II. (3 cr. Prereq–8201) Multi-perspective approach to critically evaluating journal articles, as done for peer-reviewed clinical journals. Aspects of host/pathogen interactions, including molecular/genetic mechanisms of host resistance and pathogenesis.

CMB 8333. FTE: Master’s (1 cr. Prereq–[Master’s student, adviser and DGS consent])

CMB 8335. Molecular Biology Techniques. (3 cr. §AnSc 8313. Prereq-Biol 3001, Biol 3003 or equiv or #) Basic theory and current methodologies of molecular biology and recombinant DNA technology. Lab work includes DNA and RNA hybridization, gene transfer, and polymerase chain reaction techniques. Primarily for students with limited exposure to molecular biology.

CMB 8351. Drug-Receptor Interactions. (2 cr; A-F only. Prereq–[Chem 2101 or 2102 [max 5 cr or equiv or calculus through differential equations] or #]) Dynamics of interaction between drugs and their receptors. Historical development of drug-receptor theory, factors affecting drug concentration in receptor compartment, determination of agonist and antagonist activity, pharmacodynamics of recombinant receptors, and functional receptor classification.

CMB 8361. Neuro-Immune Interactions Inter. (3 cr. §Nsc 8371, 8370. Prereq–[MVB 8201 or equiv or #]) Host immune processes at body surfaces. Innate/adaptive immunity at mucosal surfaces. Interactions/responses of various mucosal tissues to pathogens. Approaches to target protective vaccination to mucosal tissues. Lectures, journal.

CMB 8394. Research in Comparative Biomedical Sciences. (1-6 cr [max 18 cr]; Prereq–Grad MVB major) Directed research determined by student’s interests, in consultation with faculty mentor.

CMB 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

CMB 8481. Advanced Neuropharmacogenetics. (3 cr; A-F only. §Nsc 8481, Phm 8481. Prereq–#) Pharmaceutical/pharmacological issues specific to direct drug delivery to CNS. Emphasizes/integrates topics pertinent to neuropharmacology, neuropharmacokinetics, and drug delivery.

CMB 8494. Research in Molecular Mechanisms of Disease. (1-6 cr [max 18 cr]; Prereq–Grad MVB major) Directed research determined by student’s interests, in consultation with faculty mentor.

CMB 8550. Molecular Veterinary Biosciences Seminar. (1 cr [max 8 cr]; S-N only. Prereq–Biol sciences grad student) Student and faculty presentations of their own research or a directed topic.

CMB 8560. Research and Literature Reports. (1 cr [max 8 cr]; S-N only. Prereq–Grad MVB major or #) Current developments in cellular and molecular mechanisms of animal health and disease.

CMB 8570. Comparative Biomedical Sciences Seminar. (1 cr [max 8 cr]; S-N only. Prereq–Biol sciences grad student) Weekly seminar by primarily outside speakers discussing current issues.

CMB 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CMB 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

CMB 8991. Pedagogy of Cultural Studies and Comparative Literature. (3 cr. §Gscs 8991. Prereq–Grad comp lit major) Preparing graduate majors for teaching. Issues of pedagogy. Preparing syllabi for specific courses that graduate instructors teach. Required for students planning to teach in Department of Cultural Studies and Comparative Literature.

CLit 8910. Advanced Topics in Comparative Literature. (4 cr [max 32 cr]) Practical applications of specific methodologies and theories to a determined area. Topics vary by instructor and semester.

CLit 8920. Advanced Topics in Comparative Literature. (3 cr [max 15 cr]) Practical applications of specific methodologies and theories to a determined area. Topics vary by instructor and semester.

CLit 8992. Directed Reading in Comparative Literature. (1-4 cr [max 12 cr]. Prereq–#)

CLit 8994. Directed Research in Comparative Literature. (1-4 cr [max 12 cr]. Prereq–#)
Courses

**Comparative Studies in Discourse and Society (CSDS)**

**Department of Cultural Studies and Comparative Literature**

CSDS 5301. Society, Ideology, and the Production of Art. (3 cr. §CSSL 5301)

Recent critical theories of relation of arts to social/ideological forces. Selected articles from Western culture (e.g., Renaissance to 20th century; high, popular, mass culture). Music, visual art, literature.

CSDS 5302. Aesthetics and the Valuation of Art. (3 cr. §CSSL 5302)

Society, ideology, aesthetic value in light of recent critical theories of visual art, music, literature. Mediations of place, social class, gender, ideology on aesthetic judgment in post-renaissance Western culture.

CSDS 5751. Basic Concepts of Cinema. (4 cr. §CLit 5751, CSSL 5751)

Cinema as object of theoretical/historical analysis. Emphasizes concepts that have transformed scope/aim of film analysis since 1960s. Readings of filmic/theoretical texts.

CSDS 9100. Topics in Comparative Studies in Discourse and Society. (3 cr. [max 24 cr])

Themes in comparative, sociohistorical analysis of discursive practices. Individually or team taught. Topics specified in Class Schedule.

CSDS 9993. Directed Study. (1-3 cr [max 9 cr]. Prereq—Offered). Guided individual reading and study.

CSDS 8001. Basic Seminar in Comparative Studies in Discourse and Society I. (4 cr)

Key texts, positions, and problems in field of comparative critical theory. Special attention to historical precursors, influential contemporary debates, and disciplinary genealogies.

CSDS 8002. Basic Seminar in Comparative Studies in Discourse and Society II. (4 cr)

Key texts, positions, and problems in field of comparative critical theory. Special attention to historical precursors, influential contemporary debates, and disciplinary genealogies.

CSDS 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

CSDS 8404. International Hierarchical. (3 cr. §Phil 8404)

Asymmetric structures and processes of international systems; systemic conditions and implications of informal empire and structures of dependency and hegemony.

CSDS 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser and DGS consent)

CSDS 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CSDS 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

CSDS 9801. Pedagogy of Cultural Studies and Comparative Literature. (3 cr. §CLit 9801. Prereq–Grad CSDS major)

Prepare graduate majors for teaching. Issues of pedagogy. Preparing syllabi for specific courses that graduate instructors teach. Required for students planning to teach in Department of Cultural Studies and Comparative Literature.

CSDS 9810. Advanced Topics in Comparative Studies in Discourse and Society. (4 cr [max 32 cr])

Themes in comparative, sociohistorical analysis of discursive practices. Individually or team taught. Topics vary by instructor and semester.

CSDS 9820. Advanced Topics in Comparative Studies in Discourse and Society. (3 cr [max 15 cr])

Practical applications of specific methodologies and theories to a determined area. Topics vary by instructor and semester.

CSDS 9893. Directed Study in Comparative Studies in Discourse and Society. (1-4 cr [max 12 cr]. Prereq—Offered)

CSDS 9894. Directed Research in Comparative Studies in Discourse and Society. (1-4 cr [max 4 cr]. Prereq—Offered)

**Computer Engineering (CmpE)**

**Department of Electrical and Computer Engineering**

CmpE 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

CmpE 8777. Thesis Credits: Doctoral. (1-18 cr [max 50 cr]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

**Computer Science (CSci)**

**Department of Computer Science**

CSci 5103. Operating Systems. (3 cr. Prereq–4061 or #)

Conceptual foundation of operating system designs and implementations. Relationships between operating system structures and machine architectures. UNIX implementation mechanisms as examples.

CSci 5104. System Modeling and Performance Evaluation. (3 cr. Prereq–5103 or #)

Techniques for modeling computing systems for performance evaluation through analytical/simulation techniques. How to model computing systems and communications protocols to evaluate their performance under different operating conditions.

CSci 5105. Foundations of Modern Operating Systems. (3 cr. Prereq–5103 or #)

Advanced concepts that build foundations of modern operating systems. Advanced scheduling algorithms, distributed communication/synchronization, consistency/replication models, distributed file systems, security, protection/virtualization, OS architectures.

CSci 5106. Programming Languages. (3 cr. Prereq–4011 or #)

Design and implementation of high-level languages. Course has two parts: (1) language design principles, concepts, constructs; (2) language paradigms, applications. Note: course does not teach how to program in specific languages.

CSci 5107. Fundamentals of Computer Graphics I. (3 cr. §CSci 4107. Prereq–[4041 or #], fluency in C++, mastery of basic concepts in linear algebra)

Fundamental algorithms in computer graphics. Emphasizes programming projects in C/C++. Scan conversion, hidden surface removal, geometrical transformations, projection, illumination/shading, parametric cubic curves, texture mapping, antialiasing, ray tracing. Developing graphics software, graphics research.

CSci 5108. Fundamentals of Computer Graphics II. (3 cr. Prereq–5107 or #)

Advanced topics in image synthesis, modeling, and rendering. Image processing, image warping, global illumination, non-photorealistic rendering, texture synthesis. Parametric cubic surfaces, subdivision surfaces, acceleration techniques, advanced texture mapping. Programming is in C/C++.

CSci 5109. Visualization. (3 cr. Prereq–1902, 4041 or equiv or #)

Fundamental theory/practice in data visualization. Emphasizes programming applications. Volume visualization, vector field visualization, information visualization, multivariate visualization, visualization of large datasets, visualization in immersive virtual environments, and perceptual issues in effective data representation. Projects are implemented in C++ using VTK or similar visualization API.

CSci 5115. User Interface Design, Implementation and Evaluation. (3 cr. Prereq–4841 or #)

Theory, design, programming, and evaluation of interactive application interfaces. Human capabilities and limitations, interface design and engineering, prototyping and interface construction, interface evaluation, and topics such as data visualization and World Wide Web. Course is built around a group project.

CSci 5116. GUI Toolkits and Their Implementation. (3 cr. Prereq–5115 or 5107 or #)

Structure and design of user interface toolkits and frameworks. Aspects of GUI toolkits (e.g., window system protocols, event processing, geometry management, resource management, data management, constraints). Course is built around implementation assignments and case studies of toolkits.

CSci 5131. Advanced Internet Programming. (3 cr. §CSci 4131. Prereq–5106 or 5211 or #, 4801 or 5801, 5707 recommended)

Issues in internet programming: Java programming, concurrent programming, workflow, distributed databases, security, collaborative computing, object-oriented architecture/design, network publishing, messaging architecture, distributed object computing, internets.

CSci 5143. Real-Time and Embedded Systems. (3 cr. Prereq–4061 or #, experience with C language)

How to control robots and video game consoles. Lecture, informal lab.

CSci 5161. Introduction to Compilers. (3 cr. Prereq–4011 or #)

Theories and mechanisms of programming language processing tools. General compiler organization: lexical scanner, syntax parser, symbol table, internal program representation, code generator. Relationship between design and implementation. Run-time memory management mechanism.

CSci 5204. Advanced Computer Architecture. (3 cr. Prereq–4203 or EE 4363)

Instruction set architecture, processor microarchitecture, memory, I/O systems. Interactions between computer software and hardware. Methodologies of computer design.

CSci 5211. Data Communications and Computer Networks. (3 cr. §CSci 4211. Prereq–[4001 or #], basic knowledge of [computer architecture, operating systems, probability])

Fundamental concepts, protocols, and applications of computer networks. Layered network architectures, data link protocols, local area networks, network layer/routing protocols, transport, congestion/flow control, emerging high-speed networks, network programming interfaces, networked applications. Case studies using Ethernet, Token Ring, FDDI, TCP/IP, ATM, Email, HTTP, and WWW.

CSci 5271. Introduction to Computer Security. (3 cr. Prereq–4061 or equiv or #)

Concepts of computer, network, and information security. Risk analysis, authentication, access control, security evaluation, audit trails, cryptography, network/database/application security, viruses, firewalls.

CSci 5283. Computer-Aided Design I. (3 cr. Prereq–2021 or #)

CAD for digital systems. Emphasizes VLSI. Hardware description languages, synthesis, simulation, test generation.
CSci 5302. Analysis of Numerical Algorithms. (3 cr. Prereq–4707 or #)
Additional topics in numerical analysis: interpolation, approximation, extrapolation, numerical integration/differentiation, numerical solutions of ordinary differential equations.

CSci 5304. Computational Aspects of Matrix Theory. (3 cr. Prereq–5302 or #)

CSci 5403. Computational Complexity. (3 cr. Prereq–4041 or #)
Computational models, complexity measures in each model, and related complexity classes.

CSci 5421. Advanced Algorithms and Data Structures. (3 cr. Prereq–4041 or #)

CSci 5451. Introduction to Parallel Computing: Architectures, Algorithms and Programming. (3 cr. Prereq–4041 or #)
Parallel architectures design, embeddings, routing examples of parallel computers, fundamental communication operations, performance metrics, parallel algorithms for sorting, matrix problems, graph problems, dynamic load balancing, types of parallelisms, parallel programming paradigms, message passing programming in MPI, data parallel programming in HPF, shared-address space programming in threads.

CSci 5471. Modern Cryptography. (3 cr. Prereq–[2011, 4041, [familiarity with number theory or finite fields]] or #)
Introduction to cryptography. Theoretical foundations, practical applications. Threats, attacks, and countermeasures, including cryptosystems and cryptographic protocols. Secure systems/networks. History of cryptography, encryption (conventional, public key), digital signatures, hash functions, message authentication codes, identification, authentication, applications.

CSci 5481. Computational Techniques for Genomics. (3 cr. Prereq–4041 or #)

CSci 5511. Artificial Intelligence I. (3 cr. Prereq–[2011 or #])
Introduction to AI. Problem solving, search, inference techniques. Logic and theorem proving. Successful research systems and existing theory of systems design. Goal is not merely to catalog systems or learn mathematics, but to develop a sense of elegance of design that leads to successful systems.

CSci 5519. Artificial Intelligence II (non-WI). (3 cr. §CSci 5512W, Prereq–5511 or #)

CSci 5519. Artificial Intelligence II (non-WI). (3 cr. §CSci 5512W, Prereq–5511 or #)

CSci 5521. Pattern Recognition. (3 cr. Prereq–[2031, Stat 3021] or #)

CSci 5523. Introduction to Data Mining. (3 cr. Prereq–4041 or equiv or #)
Data pre-processing techniques, data types, similarity measures, data visualization/exploration. Predictive models (e.g., decision trees, SVM, Bayes, K-nearest neighbors, bagging, boosting). Model evaluation techniques. Classical (unsupervised, partitional, density-based), association analysis, anomaly detection. Case studies from areas such as earth science, the Web, network intrusion, and genomics.

CSci 5541. Natural Language Processing. (3 cr. Prereq–5511 or #)
Elements of linguistic analysis for speech and unstructured text. Phonology, syntactic parsing, semantic interpretation, information extraction. Techniques for modeling uncertainty in linguistic analysis: probabilistic models, Hidden Markov Models (HMMs), Dynamic Bayes Nets (DBNs), Probabilistic Context-Free Grammars (PCFGs), Discounting and backoff smoothing, entropy, modeling. Elements of information theory: entropy, perplexity, metrics for comparing models.

CSci 5551. Introduction to Intelligent Robotic Systems. (3 cr. Prereq–5511 or #)
Transformations, kinematics/inverse kinematics, dynamics, control. Sensing (robot vision, force control, tactile sensing), applications of sensor-based robot control, robot programming, mobile robotics, and microbots.

CSci 5552. Sensing and Estimation in Robotics. (3 cr. Prereq–[5551, Stat 3021] or #)

CSci 5561. Computer Vision. (3 cr. Prereq–[5511 or #])
Issues in perspective transformations, edge detection, image filtering, image segmentation, and feature tracking. Complex problems in shape recovery, stereo, active vision, autonomous navigation, shadows, and physics-based vision. Applications.

CSci 5707. Principles of Database Systems. (3 cr. §CSci 4707, INET 4707, Prereq–4041 or #)
Concepts, database architecture, alternative conceptual data models, foundations of data manipulation/analysis, logical data models, database designs, models of database security/integrity, current trends.

CSci 5708. Architecture and Implementation of Database Management Systems. (3 cr. Prereq–4707 or 5707 or #)

CSci 5801. Software Engineering I. (3 cr. Prereq–[1802, 2013] or #)
Advanced introduction to software engineering. Software life cycle, development models, software requirements analysis, software design, coding, maintenance.

CSci 5802. Software Engineering II. (3 cr. Prereq–5801 or #)
Introduction to software testing, software maintenance models, cost specification models, bug estimation, software reliability models, software complexity, quality control, and experience report. Student groups specify, design, implement, and test partial software systems. Application of general software development methods and principles from 5801.

CSci 5980. Special Topics in Computer Science. (1-3 cr [max 9 cr]. Prereq–#; may be repeated for cr)
Lectures and informal discussions on current topics in computer science.

CSci 5991. Independent Study. (1-3 cr [max 9 cr]. Prereq–#; may be repeated for cr)
Independent study arranged with CS faculty member.

CSci 5994. Directed Research. (1-3 cr [max 9 cr]. Prereq–#; may be repeated for cr)
Directed research arranged with faculty member.

CSci 5996. Curricular Practical Training. (1 cr [max 3 cr]; S-N only. Prereq–[5511 or CompE] major, #)
Industrial work assignment involving advanced computer technology. Reviewed by faculty member. Grade based on final report covering work assignment.

CSci 8101. Advanced Operating Systems. (3 cr. Prereq–5103 or #)
Successful research systems and existing theory of systems design. Goal is not merely to catalog systems or learn mathematics, but to develop a sense of elegance of design that leads to successful systems.

CSci 8102. Foundations of Distributed Computing. (3 cr. Prereq–5101 or #)
Fundamental principles underlying design of distributed and multiprocessor operating systems. Foundations of distributed computing systems; shared multiprocessor systems.

CSci 8115. Human-Computer Interaction and User Interface Technology. (3 cr. Prereq–5115 or #)
Current research issues in human-computer interaction, user interface toolkits and frameworks, and related areas. Research techniques, model-based development, gesture-based interfaces, constraint-based programming, event processing models, innovative systems, HCI in multimedia systems.

CSci 8161. Advanced Compiler Techniques. (3 cr. Prereq–4061 or #)
Techniques for uniprocessors and parallel computers. Fundamental program analysis instruments such as data flow analysis and data dependence analysis. Variety of code generation and transformation techniques.

CSci 8206. Parallel Computer Organization. (3 cr. §EE 8367, Prereq–5204 or EE 5304 or #)

CSci 8211. Advanced Computer Networks and Their Applications. (3 cr. Prereq–5512 or #)
Current research issues in traffic and resource management, quality-of-service provisioning for integrated services networks (such as next-generation Internet and ATM networks) and multimedia networking.
Courses

CSci 8271. Security and Privacy in Computing. (3 cr. A-F only. Prereq—5511, 5103 or #) S-N only. EE 5248 or Math 5246 or equiv recommended) Recent security/privacy issues in computer systems/networks. Threats, attacks, countermeasures. Security research, authentication, network security, wireless security, computer system security, anonymous system, pseudonym, access control, intrusion detection system, cryptographic protocols. How to pursue research in security and design secure systems.

CSci 8283. Research Problems in Computer-Aided Design for Electronic Design. (3 cr. Prereq—5201 or 5283 or equiv or #) Open research problems in contemporary CAD for electronic design, approaches to their solution.

CSci 8314. Iterative Methods for Linear Systems. (3 cr. Prereq—5304 or #) Large sparse systems. Sparse systems; methods like Jacobi, Gauss-Seidel, relaxation, and conjugate gradient; preconditioning; and parallel implementation.


CSci 8333. FTE: Master's. (1 cr. Prereq—Master's student, adviser and DGS consent)


CSci 8404. Design and Analysis of Approximation Algorithms. (3 cr. Prereq—5403 or 5421 or #) Because an exact solution is often unfeasible for computationally difficult problems in important applications, approximation algorithms are a significant area of study. Introduces techniques for design of approximation algorithms; theory for evaluating the algorithms’ performance.

CSci 8442. Computational Geometry and Applications. (3 cr. Prereq—5421 or #) Designing efficient algorithms and data structures for geometric problems. Models of computation, convex hulls, geometric duality, multidimensional search, Voronoi diagrams and Delauney triangulations, linear programming in fixed dimensions, lower bound techniques. Applications, advanced topics.

CSci 8444. FTE: Doctoral. (1 cr. Prereq—Doctoral student, adviser and DGS consent)

CSci 8481. Parallel Algorithms for Numeric and Non-numeric Problems. (3 cr. Prereq—4041 or #) Parallel algorithms for many important problems in computer science and related fields. Parallel algorithms for sorting, selection, graph problems, computational geometry, matrix problems, FFT, combinatorial search algorithms, dynamic programming, and data mining.

CSci 8521. Neural Computing and Neural Networks. (3 cr. Prereq—5511 or #) Introduction to Artificial Neural Networks (ANNs). Network architectures and learning rules; design of ANNs.

CSci 8551. Intelligent Agents. (3 cr. Prereq—5511 or #) Theories of intelligent agents. Agent architectures; knowledge representation, communication cooperation, and negotiation among multiple agents; planning and learning; issues in designing agents with a physical body; dealing with sensors and actuators; world modeling.

CSci 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CSci 8701. Overview of Database Research. (3 cr. Prereq—5708 or #) Research papers from journals and conferences on current topics in databases, such as database research methodologies, relational implementation techniques, active databases, storage systems, benchmarking, distributed and parallel databases, new data models, prototype systems, data mining, and future directions.

CSci 8703. Distributed and Parallel Databases. (3 cr. Prereq—5708 or #) Distributed database management systems (DBMS) architecture, including client-server, distributed DB design, distributed query optimization and processing; distributed transaction management (concurrency control and recovery); federated/multibases (definition and issues); database machines (concepts, successes, and failures); parallel databases.

CSci 8715. Spatial Databases and Applications. (3 cr. Prereq—4707 or 5707 or G5571 or G5573) Motivation. Models of spatial information, querying spatial data, processing strategies for spatial queries, multi-dimensional storage/access methods, spatial graph datasets, spatial data mining, trends (e.g., spatio-temporal databases, mobile objects, raster databases).

CSci 8725. Databases for Bioinformatics. (3 cr. Prereq—4707 or 5707 or #) DBMS support for biological databases, data models. Searching integrated public domain databases. Queries/analyses, DBMS extensions, emerging applications.

CSci 8760. Plan B Project. (3 cr. S-N only. Prereq—CSci MS student, #) Project arranged between student and faculty.

CSci 8777. Thesis Credits: Master's. (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

CSci 8801. Advanced Software Engineering. (3 cr. Prereq—5801 or #) Software reusability, internet/intranet programming, software reengineering, and software safety.

CSci 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

CSci 8970. Computer Science Colloquium. (1 cr [max 3 cr]; S-N only) Recent developments in computer science and related disciplines. Students must attend 13 of the 15 lectures.

CSci 8980. Special Advanced Topics in Computer Science. (1-3 cr [max 9 cr]. Prereq—#) Lectures and informal discussions.

CSci 8991. Independent Study. (1-3 cr [max 3 cr]. Prereq—#) Directed Study Experience.

CSci 8994. Directed Research in Computer Science. (1-3 cr [max 9 cr]. Prereq—#)

Conservation Biology (CBio)

College of Biological Sciences

CBio 8001. Conservation Biology Seminar. (1 cr [max 6 cr]; S-N only. Prereq—#) Topics vary.


CBio 8005. Directed Study Experience. (1-5 cr [max 6 cr]. S-N only. Prereq—#) Directed Study Experience


Control Science and Dynamical Systems (CSDy)

Institute of Technology

CSDy 8444. FTE: Doctoral. (1 cr. Prereq—Doctoral student, adviser and DGS consent)

CSDy 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CSDy 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq—Max 18 cr per semester or summer; 24 cr required)

CSDy 8899. Seminar in Control Science and Dynamical Systems. (1-3 cr [max 9 cr]; S-N only. Prereq—CSDy or IT grad) Current research and advanced topics.

Coptic (Copt)

Department of Classical and Near Eastern Studies

College of Liberal Arts

Copt 5001. Elementary Coptic. (3 cr) Introduction to Coptic grammar and vocabulary, chiefly in the Sahidic dialect.

Copt 5002. Elementary Coptic. (3 cr. Prereq—5001 or equiv) Reading a variety of Coptic literature, such as Gnostic, martYROlogical, or monastic texts.

Cultural Studies and Comparative Literature (CSCL)

Department of Cultural Studies and Comparative Literature

College of Liberal Arts

CSCL 5147. Teaching as Dialogue. (3 cr) Teaching and the teacher are the subject. Entering into dialogue is the method. Issues with the politics of teaching, the means of entering into dialogue, questions of judgment, and the idea of self-teaching as the goal of teaching.

CSCL 5154. Theoretical Constructions of Space. (3 cr) Inquiry into theories of space drawn from various disciplines including anthropology, architecture, geography, history, landscape design, philosophy, planning, and sociology. Focus on sociopolitical interests that are served and sustained; emphasis on opportunities and implications for personal identity.

CSCL 5256. Suburbia. (3 cr) Suburbia from origins in 18th-century England to the present. Historical changes and present challenges, especially in America. Ideology, mythology, planning, development, geography, transportation, the family. Specific sites and designs; representations in film, television, popular literature, and music.
Curriculum and Instruction (CI)

Department of Curriculum and Instruction

CI 5008. Theory and Practice of Teaching Art in Elementary Schools. (1-2 cr; max 3 cr; A-F only) Art concepts, skills, processes appropriate for elementary school. Methods of art instruction. Child’s production of responses to art.

CI 5045. Advanced Contemporary Crafts. (2 cr; A-F only) In-depth experiences in craft techniques, including ceramics, fiber, jewelry, and metal design, with emphasis on design analysis, understanding of materials, and mastery of processes.

CI 5049. Art Media Techniques. (1-4 cr; max 4 cr; A-F only) Lectures, demonstrations, studio labs and critique session on creative processes; handling specific media. Topic varies.

CI 5050. Issues in Art Education. (1-4 cr; max 12 cr) Issues/trends, current practices, recent research.

CI 5052. Introduction to Art Therapy. (2 cr; A-F only) History, current conceptions, and practices of art therapy.

CI 5055. Postmodern Visual Culture and Global Education. (1-3 cr; max 3 cr; Prereq—Grad student only) Representations of knowledge. Postmodern conditions of education and relationships to the influences of visual culture. Introduction to issues concerning the importance of visual imagery; influence of computer networking, mass communication, and other image sources.

CI 5065. Improving Art Programs in the Schools. (3 cr; A-F only. Prereq—Initial lic students majoring in art ed) Issues of art instruction, including teaching methods and evaluation, philosophical frameworks of pedagogy, and institutional issues concerning art programs in primary and secondary schools; social and cultural structures of schooling, practical issues of teaching art.

CI 5069. Curriculum Innovations in Art Education. (3 cr; A-F only) Study and analysis of innovations; evaluation of materials for teaching units and projects.

CI 5075. The Social and Historical Foundations of Art Education. (1-3 cr; max 3 cr; A-F only. Prereq—Grad student) Issues of culture in education; examination of various forms of art as representations of knowledge, belief, and cultural capital. Epistemology, the meaning of function, and the conceptual location of visual culture in education and culture. Seminar discussions include problems of cross-cultural and multicultural art education.

CI 5078. Application of Aesthetic Theory in Education. (2 cr; A-F only) Contemporary theories of art: psychological and philosophical foundations. Open to teachers, supervisors, and administrators concerned with art in general education at all levels.

CI 5096. Art Education: Practicum. (1-6 cr; max 6 cr; A-F only) Issues of art instruction, including teaching methods and evaluation, philosophical frameworks of pedagogy, and institutional issues concerning art programs in primary and secondary schools. Practicum requiring students to work in a public school setting.

CI 5097. Student Teaching in Art Education. (8 cr; S-N only. Prereq—Licensure student in art ed) Observation of, participation in, and supervisory experiences with various types and levels of art classes.

CI 5111. Introduction to Elementary School Teaching. (3 cr; A-F only. Prereq—Foundations of ed major or elem ed initial lic) Curriculum organization, instruction, management, assessment, professional decision making.

CI 5113. Classroom Management in the Elementary School. (3 cr) For teachers, administrators, and support staff working in elementary school programs. Focus on management of student behavior, instruction as it relates to student behavior, and teacher organizational tasks in the classroom.

CI 5133. Curriculum Planning and Design. (3 cr; A-F only. Prereq—Grad student only) Application of the theoretical and practical bases of interdisciplinary curriculum design to the problem of designing, implementing, and evaluating the quality of a course or program of study.


CI 5137. Multicultural Gender-Fair Curriculum. (3 cr; A-F only. Prereq—Grad student only) Issues related to diversity in learning settings and the exploration of culture in educational contexts. Explores rationale for and process of considering a multicultural and gender-fair curriculum; cultural issues inherent in curricular change; language, culture, sexual preference, special needs students, and the conflicts between culture and curriculum.

CI 5138. Multicultural and Moral Perspectives on Classroom Instruction. (3 cr. Prereq—MEd or PhD student) Factors leading to effective communication in ethnically diverse classroom, preschool to adult. Communication techniques and classroom structures that have cultural and moral implications.

CI 5141. Reflective Teaching and Professional Ethics. (3-4 cr [max 4 cr; Prereq—Teaching license and one yr teaching exp]) Students develop their professional identities as educators by considering their world views and values in relation to their professional role and responsibilities in the context of a diverse society. Encourages reflective practice and critical review of research.

CI 5145. Critical Pedagogy. (3 cr; S-N only) Examination of critical pedagogy; critique of power relations regarding race, class, gender, and age in various educational settings; consideration of improved practice in education for children, youth, and adults.

CI 5147. Language, Culture, and Education. (3 cr; A-F only. Prereq—MEd or grad student) Applies current sociolinguistic and discourse theory/research to study of relationships between language and culture in educational settings: language curriculum and instruction; classroom language use; borders between school and home/community language use; and educational policies on literacy/second-language instruction.

CI 5149. Issues of Diversity in Schools and Classrooms. (3 cr; max 4 cr; Prereq—Grad student or Teacher Leadership program) Examination of issues in schools and classrooms that affect people from diverse groups, using historical, communication, value, and intercultural frameworks.

CI 5150. Curriculum Topics. (1-6 cr [max 12 cr]) Special topics, current trends in curriculum. Subject integration, curriculum contexts, development, implementation, evaluation.

CI 5155. Contemporary Approaches to Curriculum: Instruction and Assessment. (3 cr; A-F only. Prereq—Grad students only) Current research/issues that cross disciplinary boundaries in curriculum development, instructional practices, and assessment methods. Interrelations among curriculum, instruction, and assessment within framework of constructivist learning theory. Individual classroom practices/theories.

CI 5162. Peer Coaching for Teachers. (1-2 cr; max 2 cr; A-F only. Prereq—Teaching experience or #) Teachers coaching teachers; acquiring concepts, skills, and dispositions necessary for observing classroom instruction and providing constructive feedback.

CI 5172. Teaching Students with Learning Difficulties. (3 cr; A-F only. Prereq—Elem teaching exp or #) Theory and practice in teaching students with learning difficulties across the curriculum.

CI 5177. Practical Research. (3 cr; A-F only. Prereq—CI MEd student, or CI or EdPA teacher leadership MEd student) Preparation for identifying a research and development topic, reviewing the existing knowledge on the topic, planning and carrying out a project, and communicating the results of the project.

CI 5178. Project in Teacher Leadership. (3-6 cr; EdPA 5361. Prereq—CI or EdPA teacher leadership MEd student) Create, implement, evaluate, and present a leadership project designed to initiate positive change in educational environments. Review related literature, proposal development, project development, implementation/evaluation, critical reflection. Share learning outcomes.
Courses

CI 5181. Clinical Experience in Elementary School Teaching. (3-6 cr; max 12 cr; S-N only. Prereq—Foundations of education and elem ed int'l licensure only) Students spend full days in the elementary classroom gradually assuming responsibility for teaching the class. Students prepare a portfolio based on criteria given. One seminar per week.

CI 5183. Applying Instructional Methods in the Elementary Classroom. (1-2 cr; max 8 cr; S-N only. Prereq—Foundations of ed major or elem ed int'l licensure only) Supervised experience in elementary classrooms.

CI 5186. School-Related Projects. (1-4 cr; max 4 cr; A-F only. Prereq—MEd student) Research or evaluation project related to teaching, curriculum, or other aspect of schooling. Approved and supervised by faculty advisor.

CI 5187. Practicum: Improvement of Teaching in Elementary or PreKindergarten Schools. (2-3 cr; max 3 cr; S-N only. Prereq—MEd student in elem or early childhood ed) Elementary school classroom teaching project designed to improve specific teaching skills. Approved and directed by advisor.

CI 5190. Directed Individual Study in Curriculum and Instruction. (1-6 cr; max 12 cr; S-N only. Prereq—Grad student only) Directs students to individual studies that focus on producing and evaluating curriculum materials; literature review of issues and problems; and assessing curriculum processes.

CI 5251. Social and Philosophical Foundations of Early Childhood Education. (3 cr. Prereq—MEd student in ECE or ECSE or #) Surveys imagery, history, philosophy, and psychology of early childhood education. Analyzing/interpreting trends in early childhood education, including diversity, special needs, legislation, public policy, and educationally appropriate practice.

CI 5252. Facilitating Social and Physical Learning in Elementary Childhood Education. (3 cr. Prereq—Student in early childhood ed or early childhood special ed) Current theoretical/empirical literature and developmental knowledge as basis for planning, implementing, and evaluating social/physical growth/development of young children. For students obtaining ECE/ECSE licensure.

CI 5253. Facilitating Cognitive and Creative Learning in Elementary Childhood Education. (3 cr; A-F only. Prereq—MEd student in early childhood ed or early childhood special ed, or #) Overview of cognitive, creative, and language characteristics of children ages 0-8 years and of how teachers can plan curriculum to facilitate children’s development in these areas.

CI 5254. Kindergarten Methods. (2 cr; A-F only. Prereq—Foundations of Education/Elementary Education or M.Ed./LP Elementary Education) Purpose of kindergarten, its place in elementary program. Curriculum appropriate for needs of age group, including children with special needs. Assessment procedures, role of classroom teacher.

CI 5281. Student Teaching in Early Childhood Education. (3-6 cr; max 6 cr; S-N only. Prereq—MEd student in early childhood ed or early childhood special ed) Application of theory/research relating to teaching preschool children. For individuals obtaining ECE/ECSE licensure.

CI 5330. Topics in Instructional Systems and Technology. (1-3 cr; max 12 cr) Topics related to needs of in-service teachers. Topics, location, credits, and duration are flexible.

CI 5331. Introduction to Instructional Systems and Technology. (3 cr; S-N only. Prereq—ECE/ECSE student) Orientation to the field to examination of various issues affecting the use of technology. Advanced students identify research topics for investigation in future courses and identify key literature in the field in preparation for masters and doctoral examinations.


CI 5337. Planning for K-12 Technology Design and Integration. (3 cr; A-F only) Designing/planning for technology integration in K-12 contexts. Focuses on school, district, state, and national levels. School visits, guest speakers, school-focused technology planning project. Use multimedia development tools to create a multimedia portfolio, and investigate the issues surrounding their effective use.

CI 5391. Technology in the Postsecondary Development Curriculum. (3 cr) Examines ways in which use of technology is transforming learning environments, teaching practices, and the curriculum in developmental education for postsecondary students. Course taught on-line.

CI 5401. Literacy for Elementary School. (3 cr; A-F only. Prereq—Children's lit course or #) Evaluative survey of books for children. Research related to children’s reading interests. Response to literature, instructional strategies.

CI 5402. Introduction to Special Collections. (3 cr; A-F only. Prereq—Children’s lit course) Uses Children’s Literature Research Collection as research material. Study of manuscripts, original art, and letters.

CI 5403. Creative Writing For and By Children. (3 cr; S-N only. Prereq—Children’s lit course or #) Aspects of writing/illustrating children’s literature or children’s own writing. May feature authors/illustrators of children’s books.

CI 5405. Middle School Language Arts Methods. (2 cr. Prereq—Elem ed licensure student) Introduction to the unique needs of middle school students in the language arts classroom. Language arts content and pedagogical skills. Adolescent development/psychology. Field placement in a middle school language arts classroom.

CI 5410. Special Topics in the Teaching of Literacy. (1-3 cr; max 12 cr) Topics related specifically to the needs of in-service teachers. Topics, location, credits, and duration will be highly flexible.

CI 5411. Teaching Reading in the Elementary School. (3 cr; A-F only) Aids the inservice elementary classroom teacher in the development of knowledge of theory and practice in the teaching of reading.

CI 5412. Reading Difficulties: Instruction and Assessment. (3 cr; A-F only. Prereq—5411 or 5451) Causes, diagnosis and assessment, prevention and correction; intervention practices useful to the classroom teacher and special teacher of reading.

CI 5413. Teaching Students with Reading Difficulties. (3 cr; A-F only. Prereq—5412) Assessment and tutoring of individual children who have difficulty reading in school.


CI 5384. Computer-Based Instruction: Games and Simulation. (3 cr; A-F only. Prereq—5363) Principles and procedures of computer simulation and game design. Types of computer simulation, the components common to simulation design, and the theory underlying educational simulation design.

CI 5365. Contemporary Software Development Issues and Tools. (2 cr. Prereq—Familiar with standard computer/Internet operations) Software used in multimedia design/development. Uses of the software, intricacies of interface, relevant programming principles. Introduction to developing multimedia applications.

CI 5367. Interactive Multimedia Instruction. (3 cr; A-F only. Prereq—Knowledge of principles and procedures of CBI design and one multimedia authoring system) Principles of effective computer-based design; tools in multimedia development; contemporary issues and skills used in the design, development, and implementation of interactive multimedia instruction. Use multimedia development tools to create a multimedia portfolio, and investigate the issues surrounding their effective use.

CI 5343. School Technology Funding. (1 cr. A-F only. Prereq—[MEd student in ECE or ECSE] or #) Surveys imagery, history, philosophy, and psychology of early childhood education. Analyzing/interpreting trends in early childhood education, including diversity, special needs, legislation, public policy, and educationally appropriate practice.

CI 5345. Facilitating Technology Integration in Classrooms II. (1 cr; A-F only. Prereq—[5344 or #, [Mac or PC with 128 MB RAM, [Windows NT or 2000 or XP] or Mac [OS 9 or OS 10]], [Pentium 2 or faster], Internet connectivity, up-to-date [Netscape, Internet Explorer], virus protection software; Certificate in School Technology Leadership or #) Developing a multi-year funding strategy for establishing K-12 technology integration in accordance with a technology use plan.

CI 5348. Facilitating Technology Implementation in Classrooms L I (1 cr; A-F only) Interception of student learning theories and research base on effective technology practices. Video cases of technology-supported teaching, peer teaching exercise.

CI 5346. Staff Technology Development and Support. (1 cr; S-N only. Prereq—Foundations of Education/Elementary Education or M.Ed./LP Elementary Education) Purpose of kindergarten, its place in elementary program. Curriculum appropriate for needs of age group, including children with special needs. Assessment procedures, role of classroom teacher.

CI 5347. Student Teaching in Early Childhood Education. (3-6 cr; max 6 cr; S-N only. Prereq—MEd student in early childhood ed or early childhood special ed) Application of theory/research relating to teaching preschool children. For individuals obtaining ECE/ECSE licensure.


CI 5337. Planning for K-12 Technology Design and Integration. (3 cr; A-F only) Designing/planning for technology integration in K-12 contexts. Focuses on school, district, state, and national levels. School visits, guest speakers, school-focused technology planning project. Use multimedia development tools to create a multimedia portfolio, and investigate the issues surrounding their effective use.

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CI 5401. Literacy for Elementary School. (3 cr; A-F only. Prereq—Children's lit course or #) Evaluative survey of books for children. Research related to children’s reading interests. Response to literature, instructional strategies.

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CI 5405. Middle School Language Arts Methods. (2 cr. Prereq—Elem ed licensure student) Introduction to the unique needs of middle school students in the language arts classroom. Language arts content and pedagogical skills. Adolescent development/psychology. Field placement in a middle school language arts classroom.

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CI 5411. Teaching Reading in the Elementary School. (3 cr; A-F only) Aids the inservice elementary classroom teacher in the development of knowledge of theory and practice in the teaching of reading.

CI 5412. Reading Difficulties: Instruction and Assessment. (3 cr; A-F only. Prereq—5411 or 5451) Causes, diagnosis and assessment, prevention and correction; intervention practices useful to the classroom teacher and special teacher of reading.

CI 5413. Teaching Students with Reading Difficulties. (3 cr; A-F only. Prereq—5412) Assessment and tutoring of individual children who have difficulty reading in school.
CI 5415. Literacy Development in the Primary Grades. (3 cr; A-F only. Prereq–Elementary teaching experience or #) Theory/practice of integrated teaching of reading, literature, writing, and language in primary classroom settings. Uses national/state language arts standards and assessment protocols to examine primary literacy curriculum.

CI 5416. Literacy Development in the Intermediate Grades. (3 cr; A-F only. Prereq–Elementary teaching experience or #) Theory/practice of integrated teaching of reading, literature, writing, and language in intermediate classroom settings. Uses national/state language arts standards and assessment protocols to examine intermediate literacy curriculum.

CI 5418. Whole Language Teaching and Learning in the Elementary School. (3 cr; A-F only. Prereq–MEd or grad student, minimum one year of teaching experience) Theory/practice of teaching writing in schools. Focuses on how race, gender, and social class impact teaching/learning.

CI 5422. Teaching Writing in Grades K-5. (3 cr; A-F only. Prereq–Initial licensure or MEd or grad student) Theory/practice of teaching writing in schools. Uses national/state language arts standards and assessment protocols to examine intermediate literacy curriculum.


CI 5431. Introduction to Instructional Leadership in K-12 Schools. (3 cr; A-F only. Prereq–Minnesota license valid for classroom teaching in pre-kindergarten, [adult basic education or grades kindergarten through 6 or 1 through 6 or 5 through 8 or 9 through 12]; or Prereq–Elementary ed intern lic) Introduction to instructional leadership in K-12 schools. Examine characteristics of effective schools within context of improving students. Leadership of students.

CI 5433. Instructional Leadership in Reading for the Middle and Secondary Grades. (3 cr; A-F only. Prereq–5432) Research-based reading instruction for elementary grades. How to help other teachers improve practice. Characteristics of effective schools within context of improving students. Leadership of students.


CI 5441. Teaching Literature in the Secondary School. (2-3 cr [max 3 cr]; A-F only. Prereq–Fall, English initial licensure only, 2 cr; other sections, 3 cr) Current theories of teaching literature; critical approaches to analyzing literature; theory and research on response to literature; adolescent literature and reading interests; methods for devising response activities and units; incorporating multicultural literature; relating media and literature; linking writing of literature to understanding literature; designing literature curriculum; evaluating and assessing students. Growth in literary response.

CI 5442. Literature for Adolescents. (3 cr; A-F only) Characteristics of literature written for adolescents; rationale for using adolescent literature; adolescents’ reading interests and attitudes; analysis of quality and appeal; individualized reading programs; methods of promoting real multiliteracy; literature; developing teaching activities.

CI 5451. Teaching Reading in Middle and Secondary Grades. (3 cr; A-F only. Prereq–Fall, English initial licensure) Methods of accommodating to students’ abilities and facilitating reading in regular content classes.

CI 5461. Teaching Composition in the Secondary School and College. (3 cr; A-F only. Prereq–Spring, English initial licensure only) Current theories of composition instruction, methods for teaching various composing processes within social contexts, uses of informal writing, linking reading and writing, describing and evaluating features of student writing, using and modeling conference strategies, using computer-mediated software, teaching writing of fiction and non-fiction, grammar and writing, editing instruction, writing assessment, uses of portfolios.

CI 5462. Evaluating and Assessing Writing. (3 cr; A-F only. Prereq–5461) Methods of evaluating writing: identifying rhetorical and linguistic features and explaining difficulties in writing; strategies for giving descriptive feedback to formal and formal writing; training for peer conferences; strategies for portfolio writing evaluation and assessment; methods for conducting large-scale writing assessments; issues of validity and reliability with writing assessments with particular application to the Minnesota Graduation Standards basic skills writing test.

CI 5472. Teaching Film, Television, and Media Studies. (3 cr; A-F only) Methods of teaching film, video, and media studies at the secondary and college level; methods for eliciting critical responses, analysis of film/video techniques; analysis of cultural representations and genre characteristics; connecting and comparing film/video and literature; studying documentary and television news; developing media studies units.


CI 5496. Directed Experiences in Teaching English. (8 cr; S-N only. Prereq–MEd/Initial licensure in English ed only) Student teaching/clinical experience for English post-baccalaureate students. Student teaching/clinical experience.

CI 5500. Special Topics: Outdoor Science Education. (1-8 cr [max 12 cr]; A-F only. Prereq–Elementary ed initial licensure only) Classroom and fieldwork activities aimed at increasing the knowledge and interest of students in teaching outdoor in all seasons. Topics include snow and ice ecology, the timber wolf and white-tailed deer, pond ecology, Twin Cities’ geology, trees and plants of Minnesota, and stargazing.

CI 5501. Teaching Science and Health in the Elementary School. (2 cr; A-F only. Prereq–Elementary ed initial licensure only) Methods and materials for teaching science and health at the elementary school level.

CI 5504. Elementary School Science: Materials and Resources. (3 cr. Prereq–Elementary ed initial licensure only) Examination of the teacher’s role in inquiry teaching; the current science curriculum; and resources for teaching science in the elementary school.


CI 5531. Teaching Middle School Science. (4 cr; A-F only. Prereq–Initial licensure in science ed) Methods of planning/teaching science to middle school students.


CI 5533. Current Developments in Science Teaching. (3 cr; A-F only. Prereq–Initial licensure, grad student or #) Using curriculum standards to design science courses.

CI 5534. Studies in Science Education. (3 cr; max 4 cr; A-F only. Prereq–M.Ed., initial lic, it lic, or #) Improvement of science teaching through the application of research findings.

CI 5535. Foundations of Science Education. (3 cr; A-F only. Prereq–M.Ed., grad student, or #) Analysis of present science teaching practices in light of historical and philosophical foundations of science education.

CI 5536. Advanced Methods of Teaching and Assessment in Science. (3 cr. Prereq–MEd or grad student or #) Development/teaching of extended science activities: structured controversies, field-based activities, service learning projects, computer-based investigations. Development of authentic assessments, students’ portfolios based on national/state guidelines.

CI 5537. Principles of Environmental Education. (3 cr; A-F only. Prereq–Graduate in NRES or M.Ed. or grad student in education or #) Critical review of Environmental Education, its history, theories, curricula, teaching methods, and assessment practices. Development of an exemplary unit plan for teaching environmental studies.

CI 5540. Special Topics: Science Education. (1-8 cr [max 12 cr]) Detailed examination and practice of the teaching of one area of science (e.g. health, physical science) or one method of instruction (e.g. laboratories, demonstrations, Internet, simulations).

CI 5596. Clinical Experience in Middle School Science. (4 cr; A-F only. Prereq–Initial licensure in science ed) Supervised clinical experience in middle school science teaching.


CI 5619. Teaching Second Languages and Cultures in Elementary Schools. (3 cr) Methods and materials for ESL and foreign languages; development of oral and written communication in a second language; alternatives in second-language program format; global awareness and cross-cultural experience; assessment of children’s language; children’s literature, games, and songs; planning and development of units and lessons.

CI 5631. Second Language Curriculum Development and Assessment. (3 cr; A-F only. Prereq–Graduate School of Education only) Developing skills for selecting, organizing, providing, and assessing effective second language learning opportunities through study, practice, and reflection.
Courses

CI 5632. Communication and Comprehension in Second Language Classrooms. (3 cr; A-F only. Prereq–SLC initial licensure only)

Comprehension and communication processes in a second language focus on listening, speaking, reading and writing, with an emphasis on initial to advanced literacy instruction; fundamental principles of effective second language instruction; the relationship of culture to proficiency in the four modalities; traditional and alternative approaches to assessing language proficiency; use of technology to enhance instruction.

CI 5634. Content-Based Instruction in Second Language Settings. (5 cr; A-F only. Prereq–SLC initial licensure only)

Content-based language instruction: principles, models and methods; learning strategy instruction; developing content-based language curriculum; traditional and alternative approaches to assessing cognitive-academic language proficiency; use of technology to enhance content-based instruction.

CI 5635. Culture and Diversity in Second Language Classrooms. (3 cr. Prereq–initial licensure program only)

Developing skills for teaching a diverse student population in both foreign language and English as a second language instructional settings through study, practice, and reflection.

CI 5642. The Assessment of Learners with Limited English Proficiency. (3 cr; A-F only)

Explores policies, procedures, and instruments in use in assessing the English language proficiency and academic readiness of limited English proficient students. American public schools: academic, cultural competence, bilingualism and special needs populations; alternative assessment; preparation of students for mainstream classrooms.

CI 5644. Working with Linguistically and Culturally Diverse Students in the Mainstream Classroom. (1 cr)

Benefits and challenges of working with linguistically and culturally diverse students; instructional practices and strategies; issues related to language learning, cultural considerations, and integration of culturally and linguistically diverse learners in the classroom.

CI 5646. Understanding and Teaching English Grammar. (3 cr. Prereq–Ling 5001 or 9)

English syntax from pedagogical perspective. Grammatical structures that challenge ESL learners. Analyzing learner errors. Issues/activities related to teaching grammar in ESL contexts.

CI 5651. Foundations of Second Languages and Cultures Education. (3 cr; A-F only)

Historical overview of second language teaching and learning in the U.S. Exploration of second language instructional settings across multiple contexts: elementary and secondary options for foreign language, bilingual education, immersion language programs, and English as a second language programs. Theoretical frameworks for language instruction are tied to practice.

CI 5652. Integrating Culture in the Second Language Classroom. (3 cr)

Exploration of culture in second language contexts. Rationale for and process of implementing cultural awareness, culture learning, and the integration of language and culture instruction as integral to effective second language development.

CI 5656. Practicum: Teaching in a Second Language Setting. (2 cr. Prereq–5619, adviser approval)

Teaching and learning experiences in a Second Language Setting at the elementary school level. Requires students to work in a public school setting.

CI 5657. Speaking and Listening in a Second Language. (3 cr; A-F only)

Theories and methods in teaching language as communication in oral and aural modes; planning student interaction; classroom organization for oral language learning and acquisition; using technology to enhance interaction; assessment of listening comprehension and oral communication.

CI 5658. Second Language Testing and Assessment. (3 cr; A-F only)

Aligning second language classroom instruction and assessment; fundamental concepts in language assessment; traditional and alternative approaches to assessing proficiency in speaking, listening, reading, writing; creation of formative and summative assessments; critique of common assessment instruments.

CI 5660. Special Topics in the Teaching of Second Languages and Cultures. (1-4 cr [max 12 cr])

Topics related specifically to the needs of the in-service teacher. Topics, location, credits, and duration are flexible.

CI 5663. Issues in Second Language Curriculum Design. (3 cr; A-F only)

Historical overview of curriculum development in second language education; contexts that influence curriculum development in second language settings; politics of curricular reform; national and state standards and implications for curriculum development; effects of technology on second language curriculum.

CI 5671. Content-Based Second Language Curriculum, Instruction, and Assessment. (3 cr. Prereq–9)


CI 5672. Language-Focused Instructional Practices and Strategies. (3 cr. Prereq–9)

Keeping a language development focus while teaching content in second language. Materials development, proactive/reactive instructional techniques, choice of form. Linguistic complexity and developmental stage of student.

CI 5693. Directed Study in Second Languages and Cultures. (1-4 cr [max 4 cr. Prereq–9]

Individual or group work on curricular, instructional, or assessment problems.

CI 5696. Practicum: Teaching World Languages and Cultures in Elementary Schools. (2 cr. Prereq–5619, advisor approval; credits cannot be counted on a graduate degree program for endorsement candidates)

Teaching and learning experiences in Second Languages and Cultures at the elementary-school level. Requires students to work in a public school setting.

CI 5697. Practicum: ESL in the Elementary School. (2 cr. Prereq–5619; advisor approval)

Teaching and learning experiences in an English as a Second Language setting at the elementary school level. Requires students to work in a public school setting.

CI 5698. Student Teaching in Second Languages and Cultures. (2 cr. Prereq–Advisor approval; credits cannot be counted on a graduate degree program) Student teaching in Second Languages and Cultures at the secondary level; meets professional licensing in another field. Requires students to work in a public school setting.

CI 5699. Clinical Experiences in Second Languages. (6-8 cr [max 8 cr. A-F only. Prereq–SLC initial licensure program only])

Teaching and learning experiences in elementary and secondary second language instructional settings. Includes a seminar held concurrently to support the student teaching experience.

CI 5701. Teaching Social Studies in the Elementary School. (2 cr; A-F only. Prereq–5111 or equiv, elem ed initial licensure only)

Content and organization of elementary social studies programs; programs of understanding, improving the learning situation, and effective use of materials.

CI 5705. Middle School Social Studies Methods. (2 cr. Prereq–Elem ed licensure only)

Introduction to the unique needs of middle school students in the social studies classroom. Social studies content and pedagogical skills. Adolescent development/psychology. Field placement in a middle school social studies classroom.

CI 5731. Social Studies for the In-Service Elementary/Middle School Teacher. (3 cr; A-F only. Prereq–Elem/middle school teaching exp or 9)

Content and organization of elementary and middle school social studies programs. Understanding and improving the teaching-learning situation through the analysis of current trends and issues in the field. Integration with other subject areas where appropriate.

CI 5741. Introduction to Social Studies Education. (3 cr; A-F only. Prereq–social studies initial licensure student)

Broad issues and themes related to social studies education, including societal context, rationale, and scope and sequence. Analysis and evaluation of selected teaching strategies, methods, and resources.

CI 5742. Advanced Methods of Teaching the Social Studies. (3 cr; A-F only. Prereq–Secondary social studies initial licensure student)

Focus on developing a repertoire of instructional methods that support authentic pedagogy and assessment. Enhancing reading comprehension and writing skills in the social studies.

CI 5743. The Social Sciences and the Social Studies. (3 cr; A-F only. Prereq–Secondary social studies initial licensure student)

Development of instructional strategies and contexts for exploring the social sciences as disciplines at the secondary level; central concepts and generalizations; tools of inquiry; comparing structures and theories; and the relative impact of multicultural and gender-fair perspectives on the nature of history and the social sciences.

CI 5744. Seminar: Reflecting on Professional Development in Social Studies Education. (1 cr [max 3 cr]; A-F only. Prereq–Secondary social studies initial licensure student)

Emphasis on reflecting on the teaching experience, developing a professional identity, and refining teaching skills.

CI 5747. Global and Environmental Education: Content and Practice. (3 cr; A-F only)

Prepares educators for leadership responsibilities in the area of global environmental education. Focus on the knowledge and process skills necessary to carry out a leadership role in the curriculum.

CI 5761. Social Studies Education for the Inservice Middle/Secondary Teacher. (3 cr)

Trends and issues in social studies education. Current developments and controversies in social studies pedagogy, curriculum, and assessment.

CI 5762. Developing Civic Discourse in the Social Studies. (3 cr; A-F only. Prereq–SOC 4002 or grad student)

Philosophies, strategies, and research on developing civic discourse in the secondary social studies classroom: selecting issues, developing a democratic classroom climate, relating to social and cultural contexts. Applicable to all of the social sciences.

CI 5762. Clinical Experiences in Teaching Social Studies. (1-8 cr [max 7 cr]; 5 cr only. Prereq–SOC 4002 or grad student)

CI 5821. Teaching Mathematics in the Elementary School. (2 cr; A-F only. Prereq–Elem ed initial licensure only)

Principles of learning pertinent to the modern program of mathematics in elementary grades. Concepts, content, philosophy, instructional materials, and methods of instruction and evaluation.
CI 5952. Family Education Perspectives. (3 cr; A-F only) Origins and critique of alternative perspectives on family education. Emphasis for educators, programs, and participants.

CI 5904. Contemporary Family Education. (3 cr; A-F only) Contemporary conditions of and transitions in family life. Emphasizes implications for educators and educational programs.

CI 5906. Program Planning in Family Education. (3 cr; A-F only) Curriculum research/theory. Alternative perspectives, their concomitant implications for families, Development of evaluation of family education curriculum/programs.


CI 5912. Sexuality Education. (3 cr) Development, delivery, and evaluation of sexuality education curriculum/programs.

CI 5914. Education for Family Communication. (3 cr) Development, delivery, and evaluation of curriculum/programs related to family communication.

CI 5922. Family and Consumer Sciences Curriculum in Grades 5-12. (3 cr. Prereq—ILP student) Examination, development, and implementation of family and consumer sciences curriculum in grades 5-12.

CI 5923. Educational Strategies in Family Education. (3 cr) Examination, development, and implementation of a variety of educational strategies.

CI 5924. Family and Consumer Sciences Student Teaching I. (1 cr [WCFE 5696, Prereq—ILP student]) Initial experiences in family/consumer sciences teaching/practice. Observations of school organization/administration, seminars, relationship building with cooperating teachers, reflections on personal involvement as beginning student teachers.

CI 5925. Family and Consumer Sciences Student Teaching II. (2 cr. WCFE 5697, Prereq—5924) Part-time supervised teaching experience in family/consumer sciences programs. On-campus seminars emphasize reflective teaching practice and student learning in context of middle/high schools.

CI 5926. Family and Consumer Sciences Student Teaching III. (3 cr. See CI 5927) Family and Consumer Sciences Student Teaching IV. (1 cr [WCFE 5698, Prereq—5926]) Full-time supervised teaching experience in family/consumer sciences programs. On-campus seminars.

CI 5927. Family and Consumer Sciences Student Teaching IV. (1 cr [WCFE 5699, Prereq—5926]) Full-time supervised student teaching experience in family/consumer sciences programs.

CI 5932. Introduction to Parent Education. (1 cr) Philosophy, history, and models of parent education. Ethical, critically reflective professional practice.


CI 5935. Practice of Parent Education II. (3 cr; A-F only, Prereq—5934 or FE 5701 or A) Development of curriculum, teaching strategies, group facilitation skills, and assessment techniques. Observation of parent education classes/programs.

CI 5936. Advanced Practice of Parent Education. (3 cr, Prereq—5935 or FE 5702 or A) Evolving perspectives of parent education. Emphasizes psycho-dynamic, conceptual-change approaches. Reflective/deliberate approaches for working with parents in understanding beliefs and examining their origins/consequences. Issues related to diversity, self-awareness, ethics, and evaluation.


CI 5939. Parent Education Practicum. (1-4 cr [max 4 cr. Prereq—5935 or FE 5702 or A]) Supervised parent education field assignments designed according to licensure requirements and individual student needs, interests, and prior competencies.

CI 5940. Everyday Lives of Youth. (3 cr; A-F only. Prereq.—YDL student or #) How youth as a social experience and social-structured reality are understood in scholarship, public discourse, and professional practice. Building a critical practice of work with and on behalf of youth.

CI 5954. Experiential Learning: Pedagogy for Community and Classroom. (3 cr) Relationship between experience and learning in community and school settings. Emphasizes intentional application of experiential learning theory/practice to educational program development.

CI 5956. Organizational Approaches to Youth Development. (3 cr; A-F only. Prereq.—YDL MEG student or #) Historical contexts, theoretical frameworks, organizational practices, and public policies that shape non-formal educational experiences of youth in community-based or school-linked settings.

CI 5958. Community: Context for Youth Development Leadership. (3 cr; A-F only) Issues/policies in family, school, and community that drive the professional practice of community-based youth work. Practical projects explore what it means to be local, to build social capital for youth, and to involve youth in community change.

CI 5960. Seminar in Youth Development Leadership. (1-4 cr [max 4 cr; S-N only, Prereq.—YDL student or #]) Group study of topics/issues. Course proposal, educational program development. Students participate in co-created learning experience with a group of peers. Four-course sequence.

CI 5962. Leadership Field Experience: Youth Development. (4 cr. Prereq—YDL, see CI 5956) Demonstration of leadership in practice. Project on youth, experiential pedagogy, and community/program settings. Focuses on public policy, advocacy, evaluation, pedagogical issues, program design, curriculum development, or applied research.

CI 5963. Directed Study in Family, Youth, and Community. (1-3 cr [max 9 cr]) Self-directed study in areas not covered by regular courses. Specific program of study is jointly determined by student and advising faculty member.

CI 5996. Internship in Family, Youth, and Community. (1-6 cr [max 6 cr]) Involvement in work experience focused on educational competencies in family, youth, and community settings. Nature/extent of responsibilities are defined by position the student assumes.

CI 8075. Seminar: Art Education. (2 cr; A-F only. Prereq—Educ grad student or #) Reports, evaluation of problems, and review of recent literature.

CI 8079. Research in Art Education. (3 cr; A-F only. Prereq—Educ grad student or #) Current research models that help students identify research questions and choose appropriate methodologies.

CI 8095. Problems: Art Education. (1-12 cr [max 12 cr. Prereq—grad arts and/or major only] Independent research under faculty guidance; may include advanced studio practice and educational issues requiring a research methodology.

CI 8111. Representations of Knowledge in Curriculum and Culture. (1-3 cr [max 3 cr. Prereq—CI grad student or #]) Overview of research and theory on sociology of knowledge and education. Conceptions of knowledge in curriculum; connections between cultural conditions and curriculum design and implementation; influence of national political agendas, population, the mass media, and textbooks on curriculum in diverse educational settings.

CI 8115. Curriculum and Achievement Outcomes in a Diverse Society. (3 cr: A-F only. Prereq—Doctoral student) Analysis of American public school experiences for students of African-American, Hispanic, Asian, and American Indian background; social, political, regional, and educational variables that influence student outcomes; perspectives concerning ethnic student achievement; factors influencing school achievement, and prospects for change.

CI 8121. Curriculum Change: Perspectives, Processes, and Participants. (3 cr. Prereq—CI grad student or #) Examination of curriculum within educational organizations; educational organization mediator and transmitter of societal/cultural perspectives; implications of organizational context for curriculum change, change processes, and change participants.

CI 8127. Curriculum Theory and Research: Alternative Paradigms and Research Methods. (3 cr. Prereq—CI grad student or #) Traditions of inquiry, exemplary studies, and associated research methods; survey and assessment of topics and methods as applied to curriculum questions; and relationships between theory and research.

CI 8131. Curriculum and Instruction Core: Critical Examination of Curriculum in Context. (3 cr; A-F only. Prereq.—CI PhD or MA student or #) Central concepts, ideas, and debates in professional field of curriculum. Curriculum in general education.

CI 8132. Curriculum and Instruction Core: Teaching Theory and Research. (3 cr; A-F only. Prereq.—CI PhD or MA student or #) Overview of teaching on teaching: historical perspective, modern research/findings, implications for practice/research.

CI 8133. Research Methods in Curriculum and Instruction. (3 cr; A-F only. Prereq.—CI PhD or MA student or #) Survey of educational research methods, comparison of underlying assumptions/procedures.

CI 8148. Conducting Qualitative Studies in Educational Contexts. (3 cr. Prereq—CI MA or PhD student or #) Introduction to use of qualitative research methods. Ethnography, sociolinguistics, symbolic interactionism. Emphasizes observation.

CI 8149. Qualitative Research: Coding, Analysis, Interpretation, and Writing. (3 cr; A-F only. Prereq—[8133, 8148, grad student, completion of a qualitative research study] or #) How to code/analyze field notes. Individual/group interviews, multimedia using audio/visual software. Students interpret analyzed material and complete an article length document that includes a review of related research/methodology.

CI 8150. Research TopicsCurr & Instruct. (1-6 cr [max 12 cr. Prereq.—MA or EdL or Ph.D.] student or #) Special topics, current research trends in curriculum/instruction. Research review, subject integration, curriculum contexts, development, implementation, data collection, analysis, evaluation.
Courses

CI 8161. Planning a Research Experience I. (2 cr. Prereq–8133, CI PhD student or #) Designing research questions, initiating literature reviews, and selecting a research methodology.

CI 8162. Planning a Research Experience II. (2 cr. Prereq–8133, CI PhD student or #) Development of research methodology, data collection devices, and processes for successful research.

CI 8181. Seminar in Teaching in Colleges of Education. (3 cr. Prereq–CI PhD student or #) Goals, instructional strategies, evaluation procedures, and professional considerations.

CI 8196. Problems: Improvement of Instruction. (1-6 cr [max 6 cr]. Prereq–#) Independent research in curriculum and instruction.

CI 8196. Practicum in Teaching in Colleges of Education. (1 cr. Prereq–8181) Supervised teaching in an education course at the University of Minnesota or another college or university.


CI 8198. Problems: Teacher Education. (1-6 cr [max 12 cr]. Prereq–#) Independent research.

CI 8333. FTE: Mentor’s. (1 cr. Prereq–Mentor’s student, adviser approval, DIS approval)

CI 8361. Advanced Courseware and Design: Issues. (3 cr; A-F only) Examination and critique of existing research. Students identify a research topic, write a literature review, plan a study, and present a research proposal.

CI 8391. Instructional Systems Seminar. (1-3 cr [max 6 cr]. Prereq–CI grad student or #) Topics related to needs of the in-service teacher; topics, location, credits, and duration are highly flexible.

CI 8395. Problems: Instructional Systems. (1-6 cr [max 12 cr]. Prereq–#) Independent research.

CI 8400. Special Topics in Children’s and Young Adult Literature. (1-6 cr [max 6 cr]. Prereq–grad course in children’s or young adult lit) Overview of research and issues. Study of original manuscripts and artwork for children’s books; research in child and young adult response to literature. Topics vary by offering.

CI 8410. Special Topics in Reading Research and Instruction. (1-6 cr [max 6 cr]. Prereq–#) Research at all levels; topics vary by offering and may include research designs, trends, and specific studies.

CI 8412. Reading in Research. (3 cr. Prereq–#) Significant literary research; critical analysis of methodology and findings, appraising research methods, population limitations, and educational implications.


CI 8444. FTE: Doctoral. (1 cr. Prereq–Doctoral student, adviser approval, DIS approval)

CI 8470. Special Topics on Literacy. (1-6 cr [max 6 cr]. Prereq–CI PhD student or #) Current theories and research on literacy and literacy development; alternative methods of conducting literacy research; implications for literacy instruction.

CI 8492. Readings in English Education and Reading. (1-2 cr [max 10 cr]. Prereq–#)

CI 8495. Problems: Teaching English and Reading. (1-6 cr [max 6 cr]. A-F only. Prereq–#) Individual research.

CI 8511. Seminar: Research in Science Education. (1 cr [max 6 cr]. Prereq–CI grad student or #) Students and faculty present research projects for comment and critique. Special topics may also be considered.

CI 8570. Advanced Topics in Science Education. (1-4 cr [max 6 cr]. A-F only. Prereq–CI grad student or #) Examination and critique of current research topics, methods, and issues.

CI 8594. Conducting Research in Science Education. (3 cr. Prereq–sci educ research course) Application of research methodology to a specific science education issue.

CI 8595. Problems: Science Education. (1-6 cr [max 12 cr]. Prereq–CI grad student or #) Independent research.

CI 8631. Research Seminar I: Second Languages and Cultures Education. (3 cr; A-F only. Prereq–8133) Students explore a research topic through readings, seminar discussions, conducting an actual study, and peer critique of work.

CI 8632. Research Seminar II: Second Languages and Cultures Education. (3 cr; A-F only. Prereq–8631) Students complete data analyses and prepare written report on an original study as well as offer peer critique of work.

CI 8650. Seminar: Special Topics in Second Languages and Cultures Research. (1-3 cr [max 6 cr]. Prereq–CI grad student or #) Research topics vary.

CI 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq–Doctoral student who has not passed prelim oral) Students complete data analyses and prepare written report on an original study as well as offer peer critique of work.

CI 8681. Readings in Second Languages and Cultures Education. (1-3 cr [max 3 cr]. Prereq–#) Independent reading.

CI 8695. Problems: Second Languages and Cultures Education. (1-6 cr [max 12 cr]. Prereq–#) Independent research.

CI 8742. Seminar: Research in Social Studies Education. (2 cr; A-F only. Prereq–CI grad student or #) Critical review and analysis of seminal research studies; criteria for appraising research findings; educational implications.

CI 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr])

CI 8795. Problems: Social Studies Education. (1-6 cr [max 12 cr]. Prereq–CI grad student or #) Independent research.

CI 8796. Research Internship in Social Studies Education. (1-6 cr [max 6 cr]. A-F only. Prereq–CI grad student) Internship with social studies education faculty member; experience in collecting and analyzing data; drafting and presenting reports; writing for publication.

CI 8880. Thesis Credits: Doctoral. (1-24 cr [max 100 cr]. Prereq–Max 18 cr per semester or summer; 24 cr required)

Dance (Dnce)

Department of Theatre Arts and Dance
College of Liberal Arts

Dnce 5010. Modern Dance Technique I. (2 cr [max 4 cr]. Prereq–A; audit registration not permitted) Continuation of technical development. Performance range/style. Students study with various guest artists.

Dnce 5020. Modern Dance Technique II. (2 cr [max 4 cr]. Prereq–5010; A; audit registration not permitted) Continuation 5010. Performance range/style. Students study with various guest artists.


Dnce 5550. Topics in Dance. (1-3 cr [max 10 cr]) Topics specified in Class Schedule.


Dnce 5700. Performance. (1 cr [max 4 cr]. Prereq–Technique course) Technique, improvisation, choreography, music, design, and technical production as they relate to dance performance.

Dnce 5858. Teaching Dance. (4 cr. Prereq–1020; #) Methods, principles, and techniques of teaching dance.

Dnce 5970. Directed Studies. (1-4 cr [max 10 cr]. Prereq–#) Guided individual study.

Dentistry (Dent)

School of Dentistry

Dent 5101. Oral and Maxillofacial Radiology. (3 cr; A-F only) General principles of radiology, radiation physics, dosimetry, biology, radiation protection, regulations and recent concepts of imaging.


Dent 5103. Oral Radiology Preclinical Lab I. (1 cr; S-N only) This course consists of preclinical demonstration-participation phases in radiographic technique using mounted human skulls.

Dent 5104. Oral Radiology Preclinical Lab II. (1 cr [max 2 cr; S-N only) This course consists of preclinical demonstration-participation phases of radiographic technique using mounted human skulls.

Dent 5121. Physical Evaluation I. (3 cr; A-F only) General concepts of diagnosis and patient evaluation for use during examination of patients in various adult clinical programs in the School of Dentistry.

Dent 5201. Pain and Anxiety Control. (2 cr; A-F only) Didactic/clinical aspects of pain/anxiety control as it pertains to dentistry. Emphasizes use of local anesthetics, conscious sedation (nitrous oxide inhalation). Acute/chronic pain mechanisms, neuropathic pain, issues pertaining to narcotic/other drug abuse.
Dent 5301. Introduction to Oral Biology. (2 cr; S-N only) Introduction to the biology of the oral cavity. Oral microbiology, biochemistry, tissues, diseases, and pain will be related to clinical practice through lectures and discussions of current literature.

Dent 5302. Topics in Dental Biochemistry. (2 cr; A-F only) Biological, chemical, and biochemical phenomena occurring in the oral cavity and the interrelationships between these phenomena. Biological and chemical basis of dental caries and how saliva, dental plaque, and plaque fluid interact and impact on the caries process. Metabolic handling and anticaries mechanisms of fluoride.

Dent 5303. Microbiology for Dental Students. (6 cr; A-F only. Prereq--Dental Biochemistry/Histology) General microbiology, bacterial pathogenesis, virology with specific emphasis on oral microbial ecology, dental caries and periodontal diseases. Evaluation of current literature will be done by student essays. Discussions are based on assigned literature and focus on methodology.

Dent 5315. Oral Histology and Embryology and Medical Genetics. (3 cr; A-F only. S&DH 2310) Embryologic development and histologic structure of tissues in the head, face, and mouth with emphasis on clinical correlations, principles of medical genetics, complex traits of the orofacial region, and genetic contributions to oral diseases.

Dent 5321. Introduction to Dental Biomaterials. (2 cr; A-F only) This introductory course includes ten laboratory sessions and ten lectures. In the laboratory class, students practice handling materials used in restorative dentistry and prosthodontics. Accompanying lectures provide a scientific foundation for selection and use of dentistry materials.

Dent 5322. Applied Dental Biomaterials. (2 cr; A-F only) Lectures on applications of dental materials, including areas of restorative dentistry, prosthodontics, orthodontics, and endodontics. Instruction in the scientific basis for selection and utilization of materials. Areas of current controversy, including replacement of traditional materials with new materials. Literature review seminars cover the evaluation principles for information sources on dental materials.

Dent 5401. Dental Care Delivery and Oral Epidemiology. (3 cr; A-F only. S&DH 4131) Dental public health. Epidemiology, biostatistics, professional ethics, financing of dental care, health economics, health policy. Students participate in site visits and search, manage, and evaluate dental information from various resources.


Dent 5411. Professional Problem Solving. (0 cr; A-F only) Critical thinking in ethical/professional problems in dentistry. How to organize, analyze, and reflect on issues, rights, responsibilities, codes of behavior/ethics, and consequences.

Dent 5412. Professional Problem Solving. (1 cr; A-F only) Critical thinking in ethical/professional problems in dentistry. How to organize, analyze, and reflect on issues, rights, responsibilities, codes of behavior/ethics, and consequences.

Dent 5441. Patient Management II. (3 cr; A-F only) Introduction to management of dental patients. Process development of comprehensive treatment plans. Students are exposed to treatment planning in private-practice setting.

Dent 5501. Pediatric Dentistry Pre-Clinic. (2 cr; A-F only) Physical, emotional, and language development; diagnosis, prevention, and management of oral diseases in children.

Dent 5601. Introduction to Clinical Preventive Dentistry. (2 cr; S-N only) Application of principles of prevention through case-based small group learning format and clinical experiences. Clinical observation of preventive protocols/techniques. Students prepare/deliver presentation on preventive topic.


Dent 5612. Periodontology Technique. (2 cr; A-F only) Presurgical procedures in periodontics. Development of clinical skills to examine, diagnose, prevent, and treat periodontal patients.

Dent 5613. Periodontology Technique II, I (1 cr; S-N only, Prereq--5612) Extension of Dent 5612. Closely supervised, students treat at least three periodontal patients during the summer semester. Students develop clinical skills to examine, diagnose, prevent, and treat periodontal patients before assuming responsibility for their comprehensive care.

Dent 5701. Introduction to Endodontics Lecture and Laboratory. (4 cr; A-F only) Study of morphology, physiology, and pathology of the human dental pulp and periradicular tissues.


Dent 5802. Operative Dentistry I Laboratory. (3 cr; A-F only. Prereq--Dental Anatomy, Biomaterials) Restoration of small caries lesions, cervical abrasion lesions, and attrition defects in clinical simulation setting. Emphasizes designing/executing retractive/ resistant restorations, conserving tooth structure, and operating in clinically relevant orientations. Self-evaluation techniques, discriminatory skills.


Dent 5805. Operative Dentistry III. (3 cr; A-F only. Prereq--Operative Dentistry I, II) Lab Integration/application of skills/knowledge in diagnosis, treatment planning, and treatment. Clinical setting.

Dent 5901. Oral Anatomy I. (2 cr; A-F only) Tooth morphology, nomenclature, classification, charting, calcification, and eruption sequences; mouth growth and development.

Dent 5902. Oral Anatomy Laboratory I. (2 cr; A-F only) Application of oral anatomy, fixed prosthodontics lab techniques, fundamentals of tooth preparation.

Dent 5903. Preclinical Prosthodontics Lecture II. (2 cr; A-F only. Prereq--5901, 5902) Prosthetic procedures.
Courses

Dent 8123. Advanced Topics in Orofacial Pain. (3 cr; A-F only. Prereq–Grad student in dentistry or other health sciences grad student or #) Review of cutting edge research and clinical findings regarding etiology/treatment of acute/chronic orofacial pain conditions and related disorders.

Dent 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)

Dent 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr]. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Design Institute (Desl)

College of Architecture and Landscape Architecture

Desl 5100. Design Institute Directed Study. (1-3 cr [max 6 cr]; A-F only) Guided independent study in design.

Design, Housing, and Apparel (DHA)

Department of Design, Housing, and Apparel

College of Human Ecology

DHA 5111. History of Decorative Arts. (4 cr; A-F only. Prereq–General art history survey course or #) In-depth study of textiles, ceramics, metal, and glass from selected historical periods. Focus on the Goldstein Gallery collections.

DHA 5170. Special Topics in Design, Housing, and Apparel. (1-4 cr [max 8 cr]; A-F only) In-depth investigation of a single specific topic, announced in advance.

DHA 5193. Directed Study in Design, Housing, and Apparel. (1-4 cr [max 4 cr]; A-F only. Prereq–#) Independent study in design, housing, and apparel under tutorial guidance.

DHA 5196. Field Study: National/International. (1-10 cr [max 10 cr]; A-F only) Faculty-directed field study in a national or international setting.

DHA 5215. Product Development: Softlines. (4 cr; A-F only. Prereq–2213 or clothing design major or retail merchandising major or grad student or #) Product development for apparel and other sewn products. Developing products in a laboratory studio setting for effectiveness, reliability, and marketability. Team approach using merchandising and design principles to develop products for specific markets.

DHA 5216. Retail Promotion and Consumer Decision Making. (4 cr; A-F only. Prereq–12101, 2213, [jr or sr or grad student]. [DHA major or minor] or #) Consumer behavior theories/concepts as related to apparel. Application to understanding/developing retail promotional strategies: advertising/promotion.

DHA 5381. Digital Illustration. (3 cr; A-F only. Prereq–4334, [DHA major or grad student]) Integration of design with computer applications. Use of raster/vector-based programs for illustration.

DHA 5382. Digital Sound and Video. (3 cr; A-F only. Prereq–4334, [DHA major or grad student]) or #) Design solutions involving time-based media. Emphasizes sound/video. Electronic publishing via Internet.

DHA 5383. Animation Design. (3 cr; A-F only. Prereq–4334, [DHA major or grad student]) or #) Animation in time-based electronic design. Introduction to three-dimensional modeling.

DHA 5385. Internet-Based Media. (3 cr; A-F only. Prereq–4334, [DHA major or grad student]) or #) Designing interactive presentations (using various operating systems) for Internet/Web. Electronic publishing. Development of Internet-based communication.

DHA 5386. Design Planning, Analysis, and Evaluation. (3 cr; A-F only. Prereq–4354, DHA major or grad student or #) Preliminary research, including theoretical, applied, and legal aspects. Planning/developmental models. Design prototyping, testing, and analysis.

DHA 5399. Theory of Electronic Design. (3 cr; A-F only. Prereq–[DHA major or grad student or #] offered alternate yrs) Theories, methodologies, histories of electronic design, its impact on visual communications. Digital artifacts, processes, paradigms.

DHA 5463. Housing Policy. (3 cr; A-F only. §PA 5261. Prereq–2401, 2463 or #) Explore the institutional and environmental settings that make up housing policy in the United States. Examine competing ideas about solving the nation’s housing problems through public intervention in the market. Federal and local public sector responses to housing problems will be evaluated.

DHA 5467. Housing and the Social Environment. (4 cr; A-F only. Prereq–2401 or #) Housing choices in context of social environment. Emphasizes special needs of elderly, disabled, minorities, large families, female-headed households, and low-income households. Students conduct a post-occupancy evaluation of housing.

DHA 5469. Understanding Housing: Assessment and Analysis. (3 cr; A-F only. Prereq–[2401, 2463] or #) How to formulate housing research problems and analyze/present information about housing characteristics/conditions. Students develop housing-related research/grant proposals, use/design cartographic/graphic information about housing, and give a presentation on a research project.

DHA 5471. Housing Studies Certificate Seminar. (2 cr; A-F only. Prereq–Admitted to Housing Studies Certificate Program). Integrative seminar and “capstone” to Certificate program. Students prepare an individual career plan that focuses on application of housing studies to community/workplace.

DHA 5481. Housing for the Elderly and Special Populations. (3 cr; A-F only. Prereq–2401 or #) Introduction to the changing housing needs of individuals and families across the life span. Particular emphasis will be on housing needs of children, older adults, and persons with disabilities.

DHA 5484. Rural Housing Issues. (3 cr; A-F only. Prereq–2401, 2463 or #) Housing issues in nonmetropolitan areas. The housing concerns of specific rural populations (e.g., low income, elderly persons, American Indians, migrant workers) are identified and comparisons with urban housing issues are made.

DHA 8010. Philosophical Foundations of Design, Housing, and Apparel. (4 cr; A-F only) The nature of thought underlying and within professional areas of the field.

DHA 8013. Methodological Orientations: Qualitative Research. (3 cr; A-F only) Assessment of field research methods relevant to research regarding material culture. Relationship of selected research problem (and its theoretical framework) to practical problems of fieldwork. Rationale and plan for appropriate field methods of data collection.

DHA 8111. Design Theory and Criticism. (3 cr; A-F only) Students establish a framework for criticism by examining various theories used in design disciplines, study existing designed environments to explain the designer’s purpose, identify problem-solving processes, and describe interaction between humans and design. Field investigations.

DHA 8113. Education and Evaluation in Design, Housing, and Apparel. (4 cr; A-F only. Prereq–#) Educational processes/methods used in design studio/lecture courses. Learning styles, best practices for grading, alternative methods of critique, interacting with students, active learning strategies, teaching with technology. Lecture (3 cr), practicum (1 cr).

DHA 8114. Design Studio. (4 cr; A-F only. Prereq–#) Advanced problem analysis, design solution.

DHA 8164. Innovation Theory and Analysis. (3 cr; A-F only) Theories and factors that influence adoption and diffusion of designed products. Methodologies used in analysis of diffusion process.

DHA 8170. Topics in Design, Housing, and Apparel. (1-3 cr [max 6 cr]; A-F only. Prereq–Varies with topic) In-depth investigation of a topic announced in advance.

DHA 8180. Professional Seminar in Design, Housing, and Apparel. (1-2 cr [max 4 cr]; A-F only) Professional development issues and trends.

DHA 8181. Ethics and Research. (1 cr; S-N only. Prereq–Grad student) Overview of ethical concerns/questions in conducting/disseminating research. Mentoring relationships, use of human subjects, data handling, plagiarism, authorship, publishing, research funding, social responsibility of researchers, code of conduct.

DHA 8192. Readings in Design, Housing, and Apparel. (1-3 cr [max 8 cr]; A-F only. Prereq–#) Independent study and review of books and periodicals under tutorial guidance.

DHA 8193. Directed Study in Design, Housing, and Apparel. (1-3 cr [max 8 cr]; A-F only. Prereq–#)

DHA 8222. Plan B Master’s Project. (3 cr; S-N only. Prereq–DHA master’s student) Plan B master’s project.

DHA 8262. Writings on Dress: Historical Perspectives. (3 cr; A-F only) Dress as a significant factor in human interaction prior to 1940. Early social science and philosophical writing, beginning with Montaigne in 1537. These perspectives appraised for relevance to current research and theory.

DHA 8263. Writings on Dress: Contemporary Themes. (3 cr; A-F only. Prereq–B101 or #) Current conceptualizations and thematic areas in literature of textiles and apparel.

DHA 8265. Dress: Race, Class, and Gender. (3 cr; A-F only. Prereq–4212 or #) Dressing the body as a sociocultural and personal expression of an individual’s identity. Gender, race, and class differences in apparel explored to understand the global market, international and niche retailing, as related to clothing practices.


DHA 8267. Dress and Culture. (3 cr; A-F only. Prereq–4212 or #) Cultural factors of identity expressed through dress. Focuses on issues of cultural diversity through analysis of dress and textiles within a specific world region.

DHA 8333. FTE: Master’s. (1 cr. Prereq–Master’s student, adviser and DGS consent)
For definitions of course numbers, abbreviations, and symbols, see page 167.

DHA 8361. Color, Design, and Human Perception. (3 cr; A-F only. Prereq—DHA 3120 or DHA 3170 or #) Color psychology course or #. Perceptual and psychological aspects of color and design. Human factors of color variables and design strategies that can enhance human experience of, and interaction with, color.

DHA 8362. The Nature of Representation in Visual Communication. (3 cr; A-F only. Prereq—Grad DHA major or #) Relationship of images to the design communication process. Aspects of representation and pictorial information modes. Human interaction with images and their role in increasing understanding, enhancing learning, and positively affecting human experience.

DHA 8444. FTE: Doctoral. (1 cr. Prereq—Doctoral student, adviser and DGS consent)

DHA 8463. Housing: Race and Class. (3 cr; A-F only) Roles of difference (race, gender, class) in shaping distribution of housing, particularly in cities. Role of housing in patterns of social differentiation.

DHA 8467. Theoretical Perspectives in Housing Studies. (3 cr; A-F only. Prereq—DHA 5467 or #) Investigation/evaluation of theories applied to study of housing. Levels of analysis. Links between theory, research questions, and methodological approaches.

DHA 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq—Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

DHA 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr]. Prereq—Max 18 per semester or summer; 10 cr total required [Plan A only])

DHA 8888. Thesis Credit: Doctoral. (1-24 cr [max 100 cr]. Prereq—Max 18 per semester or summer; 24 cr required)

DHA 8990. MFA Creative Thesis. (6 cr [max 12 cr]; A-F only. Prereq—Completed coursework requirements for MFA in DHA w/multimedia emphasis, #) MFA project.

Development Studies and Social Change (DSSC)

DSSC 8111. Approaches to Knowledge and Truth: Ways of Knowing in Development Studies and Social Change. (3 cr; S-N only. Prereq—Grad DSSC minor or #) Approaches practiced by physical, biological, and social scientists and humanities scholars. “Ways of knowing” in different cultures or in different groups within cultures. Team taught by faculty from biological and social sciences and the humanities.

DSSC 8211. Doctoral Research Workshop in Development Studies and Social Change. (1 cr; S-N only. Prereq—Grad DSSC minor or #) Identification of potential funding sources for field research and the writing of grant proposals. Preparing for and conducting field research. Taken during the year before undertaking field research, typically the third year of graduate study.

DSSC 8212. Doctoral Research Workshop in Development Studies and Social Change. (1 cr; S-N only. Prereq—Grad DSSC minor or #) Identification of potential funding sources for field research and the writing of grant proposals. Preparing for and conducting field research. Taken during the year before undertaking field research, typically the third year of graduate study.

DSSC 8310. Topics in Development Studies and Social Change. (2-3 cr [max 9 cr]. Prereq—Grad DSSC minor or #) Offered in conjunction with MacArthur Program on Peace and International Cooperation workshop series.

Dutch (Dutch)

Department of German, Scandinavian, and Dutch

College of Liberal Arts

Dutch 5490. Topics in Dutch Literature. (3 cr [max 9 cr]) Topic may focus on a specific author, group of authors, genre, period, or subject matter. Topics specified in Class Schedule.

Dutch 5993. Directed Studies. (1-4 cr [max 12 cr]. Prereq—#) Guided individual reading or study.

East Asian Studies (EAS)

Institute of International Studies

College of Liberal Arts

EAS 5040. Topics in Asian History. (1-4 cr [max 16 cr]. Prereq—Grad or intr consent) Selected topics such as cultural, economic, intellectual, political, and social history.

EAS 8323. FTE: Master’s. (1 cr. Prereq—Master’s student, adviser and DGS consent)

EAS 8777. Thesis Credits: Master’s. (1-18 cr [max 50 cr]. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Ecology, Evolution, and Behavior (EEB)

Department of Ecology, Evolution, and Behavior

College of Biological Sciences

EEB 5001. Spatiotemporal Dynamics of Plant Communities. (3 cr. Prereq—[Biol 3407, 4014] or #) Dynamic nature of plant communities in times of environmental changes. Emphasizes species invasion as key for structure/dynamics of plant assemblages. Observational, theoretical, and experimental studies on spatiotemporal dynamics of plant communities under various changes in biological/environmental conditions, including human-induced Global Warming.

EEB 5008. Forest Response to Quaternary Climate Change. (2 cr; A-F only. Prereq—Biol 3407, EEB 4631 or Geo 4631 [current registration EEB 5009]) Forest responses to past climate change at the population, community, and ecosystem level. Response to natural and human disturbance, range shifts and invasions. Limitations to the speed of response to rapid climate change.


EEB 5011. Pollen Morphology. (2 cr. Prereq—Biol 3007, PBio 4321 or #) Morphology and nomenclature of pollen grains and pteridophyte spores, survey of pollen and spores of major plant families, lab techniques.

EEB 5013. Quantitative Plant Macrofossils. (2 cr. Prereq—PBio 4321 or 4511 or #) Morphology of seeds, fruits, and other macroscopic remains likely to occur in Quaternary deposits, survey of fossils of major plant families, lab techniques.


EEB 5051. Analysis of Populations. (3 cr. SFW 5051. Prereq—Intro biology, intro statistics or #) Factors involved in the regulation, growth, and general dynamics of populations. Data needed to describe populations, population growth, population models, and regulatory mechanisms.

EEB 5053. Ecology: Theory and Concepts. (4 cr. Prereq—Biol 3407 or #) Classical and modern mathematical theories of population growth, interspecific interactions, ecosystem dynamics and functioning, with emphasis on underlying assumptions and on effects of added biological reality on robustness of predictions, stability, interspecific interactions, ecosystem structure and functioning.

EEB 5122. Plant Interactions with Animals and Microbes. (3 cr; A-F only. Prereq—Biol 2012 or 3002, 3407 or 3409) Ecological and environmental implications of mutualistic and antagonistic interactions between plants, animals and microbes at organismal, population, and community levels.

EEB 5124. Plant Physiological Ecology. (4 cr) Plant function, its plasticity/diversity in an ecological context. Impact of environmental stresses on major physiological processes of plants, including photosynthesis, respiration, water uptake/transport, and nutrient uptake/assimilation. Lab, field trip to Cedar Creek.


EEB 5221. Molecular and Genomic Evolution. (3 cr; A-F only. Prereq—[Biol 4003 or GCD 3022, grad student] or #) Molecular basis of evolutionary change. Current studies of selection and neutral evolutionary processes at molecular level. Evolution from gene to genome level: protein structure and function, nuclear gene families, organelle genomes, genome organization. Lectures, discussions of current literature, and workshops where students practice analyses.

EEB 5321. Evolution of Social Behavior. (3 cr; A-F only. Prereq—Biol 3411 or #) Introduction to theories and concepts relating to behavior evolution, mating systems, and cooperative behavior in animals.

EEB 5322. Evolution and Animal Cognition. (3 cr. Prereq—Biol 3411 or Psi 3061 or #) Animal cognitive abilities. Learning, perception, memory, navigation, and communication from evolutionary/comparative perspective. Cognitive abilities as adaptations that solve specific environmental problems. Empirical methods for assessing cognitive abilities. Emphasizes parsimonious interpretations of data. Controversial topics such as animal intelligence, animal language and whether non-human animals have a “theory of mind.”

EEB 5323. Neural and Endocrine Mechanisms Underlying Vertebrate Behavior. (2 cr; A-F only. Prereq—Biol 3411 or Biol 3101 or Nsc 3101 or Phil 3101 or #) Selected aspects of the physiological basis of vertebrate behavior with emphasis on neural and endocrine integration and the effects of evolutionary pressures on it. Hormones and sex behavior, sensory perception, neuroethology of communication.
EEB 5327. Behavioral Ecology. (3 cr. Prereq--Biol 3411 or #) Evolutionary principles applied to aggressive competition, mate choice, cooperation, and parental investment. Optimization models used to examine foraging strategies, predator/prey interactions, and territoriality. Evolution of sex, sexual selection, dispersal. Evolutionary game theory.

EEB 5361. Visions of Nature: The Natural World and Political Thought. (4 cr. Prereq--Advanced studies in history, philosophy, or biology) Theories about the organization of nature, human nature and their significance for the development of ethics, religion, political and economic philosophy, civics, and environmentalism in Western and other civilizations. Graduate credit requires paper on conceptual topics in human ecology.


EEB 5609. Ecosystem Ecology. (3 cr. Prereq--Biol 3407 or Biol 5407) Regulation of energy and elements cycling through ecosystems. Dependence of cycles on kinds/numbers of species within ecosystems. Effects of human-induced global changes on functioning of ecosystems.


EEB 5963. Modeling Nature and the Nature of Modeling. (3 cr. EE 3963. Prereq--[Math 1281, Math 1282] or equiv or #) Hands-on modeling experiences in context of biological applications. Reviews calculus concepts. Students carry out modeling steps, from developing the model, to analytical analysis, to developing computer code, to running the models.

EEB 8010. Seminar in Paleoecology. (1 cr [max 4 cr]; S-N only. Prereq--#) Reading and discussion of recent literature on Quaternary paleoecology.

EEB 8020. Community Ecology Seminar. (1 cr [max 5 cr]; S-N only. Prereq--#) Research topics in selected areas.

EEB 8050. Population Biology Seminar. (1 cr [max 5 cr]; S-N only. Prereq--#) Research topics in selected areas.

EEB 8051. Empirical Ecology. (4 cr. Prereq--stat or biometry course or #) Overview of analytical methods in interpreting data collected from observational and experimental studies in ecology and related fields of evolution, behavior, and conservation biology. Univariate, bivariate, and multivariate methods, including computationally intensive methods, ordination, and hypothesis testing.

EEB 8060. Evolutionary Genetics Seminar. (1 cr [max 5 cr]; S-N only. Prereq--#) Research topics in selected areas.

EEB 8333. FTE: Master's. (1 cr. Prereq--Master's student, adviser and DGS consent)

EEB 8360. Behavioral Ecology Seminar. (1 cr [max 5 cr]; S-N only. Prereq--#) Research topics in selected areas.

EEB 8444. FTE: Doctoral. (1 cr. Prereq--Doctoral student, adviser and DGS consent)


EEB 8686. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]. Prereq--Max 19 cr per semester or summer; doctoral student who has not passed prelim orally)

EEB 8777. Thesis Credits. Master's. (1-18 cr [max 50 cr]. Prereq--Max 18 cr per semester or summer; 10 cr total required [Plan A only])

EEB 8888. Thesis Credit. Doctoral. (1-24 cr [max 100 cr]. Prereq--Max 18 cr per semester or summer; 24 cr required)

EEB 8880. Seminar on Current Topics. (1-3 cr [max 6 cr]; S-N only. Prereq--[1st yr or 3rd sem] grad student, #) Current research in ecology, evolution, and behavior.

EEB 8990. Graduate Seminar. (1 cr [max 5 cr]; S-N only. Prereq--#) Research topics in selected areas.

EEB 8991. Independent Study: Ecology, Evolution, and Behavior. (-10 cr [max 10 cr]; S-N only. Prereq--#) Individual research on a specialized topic.

EEB 8994. Directed Research. (-1 S-N only. Prereq--#)

Econ 5109. Game Theory for Engineers. (4 cr; A-F only. Prereq--[(Math 2233, Math 2373, Math 3303) or Math 4560]. M.S./Ph.D. student in [engineer or comp sci or info tech or operations mgmt] or #; not for econ undergrads or PhD students)


Econ 5151. Elements of Economic Analysis: Firm and Household. (2 cr. Prereq--5101, 3102, or equiv, Math 1271 or equiv, Math 2243 or equiv, grad or #) Decision-making by households and firms under conditions of perfect competition, monopoly, and monopolistic competition.

Econ 5152. Elements of Economic Analysis: Income and Employment. (2 cr. Prereq--5101, 3102 or equiv, Math 1271 or equiv, Math 2243 or equiv, grad or #) Determinants of national income, employment, and price level; aggregate consumption, investment, and asset holding.

Econ 5312. Growth, Technology, and Development. (3 cr. Prereq--5101, 3102 or equiv) Economics of research and development; technical change and productivity growth; impact of technology on institutions; science and technology policy.

Econ 5890. Economics of the Health-Care System. (3 cr; A-F only. Prereq--5832. Prereq--[3101, 3102] or #) Economic analysis of U.S. health-care sector. Emphasizes problems of pricing, production, distribution. Health-care services as one factor contributing to nation’s health.

Econ 8001. Microeconomic Analysis. (2 cr. Prereq--5151 or equiv, Math 2243, Math 2263 or equiv or #) Theories of consumer demand, producer supply, and market equilibrium; general equilibrium and welfare. Sample topics: externalities, economics of information and uncertainty, and game theory. This seven-week course meets with 4161.

Econ 8002. Microeconomic Analysis. (2 cr. Prereq--8001) Theories of consumer demand, producer supply, and market equilibrium; general equilibrium and welfare. Sample topics: externalities, economics of information and uncertainty, and game theory. This seven-week course meets with 4163.

Econ 8004. Macroeconomic Analysis. (2 cr. Prereq--8003) Theories of consumer demand, producer supply, and market equilibrium; general equilibrium and welfare. Sample topics: externalities, economics of information and uncertainty, and game theory. This seven-week course meets with 4164.

Econ 8010. Microeconomic Theory. (2 cr. Prereq--5151 or equiv, Math 2243 or equiv, Math 5815 or concurrent registration in Math 8861, grad econ major or #) Decision problems faced by the household and firm; theories of choice under conditions of certainty and uncertainty. Partial equilibrium analysis of competition and monopoly. General equilibrium analysis. Welfare economics: economic efficiency of alternative market structures, social welfare functions. Dynamics: stability of markets, capital theory. Seven-week course.


Econ 8013. Microeconomic Theory. (2 cr. Prereq--8012, Math 5615 or Math 8602 or comparable math course, grad econ major or #) Decision problems faced by the household and firm; theories of choice under conditions of certainty and uncertainty. Partial equilibrium analysis of competition and monopoly. General equilibrium analysis. Welfare economics: economic efficiency of alternative market structures, social welfare functions. Dynamics: stability of markets, capital theory. Seven-week course.

Econ 8014. Microeconomic Theory. (2 cr. Prereq--8013, Math 5616 or Math 8602 or comparable math course, grad econ major or #) Decision problems faced by the household and firm; theories of choice under conditions of certainty and uncertainty. Partial equilibrium analysis of competition and monopoly. General equilibrium analysis. Welfare economics: economic efficiency of alternative market structures, social welfare functions. Dynamics: stability of markets, capital theory. Seven-week course.

Econ 8015. Macroeconomic Theory. (2 cr. Prereq--5152 or equiv, Math 2243, Math 2263 or equiv or #) Dynamic general equilibrium models: solving for paths of interest rates, consumption, investment, prices. Models with uncertainty, search, matching, indivisibilities, private information. Implications for measurement and data reporting. Overlapping generations and dynasty models. Variational and recursive methods. This seven-week course meets with 4165.

Econ 8016. Macroeconomic Theory. (2 cr. Prereq--8015, Math 5615 or Math 8602 or comparable math course, grad econ major or #) Dynamic general equilibrium models: solving for paths of interest rates, consumption, investment, prices. Models with uncertainty, search, matching, indivisibilities, private information. Implications for measurement and data reporting. Overlapping generations and dynasty models. Variational and recursive methods. This seven-week course meets with 4166.

Econ 8017. Macroeconomic Theory. (2 cr. Prereq--8016, Math 5615 or Math 8602 or comparable math course, grad econ major or #) Dynamic general equilibrium models: solving for paths of interest rates, consumption, investment, prices. Models with uncertainty, search, matching, indivisibilities, private information. Implications for measurement and data reporting. Overlapping generations and dynasty models. Variational and recursive methods. This seven-week course meets with 4167.

Econ 8111, Introduction to Mathematical Economics. (2 cr. Prereq—Math 2324 or equiv, Econ 8101, Math 5615 or equiv or Math 4242 recommended) Use of mathematical models in economic theory. 

Econ 8112, Introduction to Mathematical Economics. (2 cr. Prereq—8111, Math 5615 or comparable abstract math course) Use of mathematical models in economic theory. Standard techniques.

Econ 8113, Introduction to Mathematical Economics. (2 cr. Prereq—8112, Math 5616 or comparable abstract math course, 103) Use of mathematical models in economic theory. May include special topics.

Econ 8117, Noncooperative Game Theory. (2 cr. Prereq—Math 5616 or equiv or 103) Solution concepts for noncooperative games in normal form, including Nash and perfect equilibrium and stable sets of equilibria. Extensive form games of perfect and incomplete information, sequential equilibrium, and consequences of stability for extensive form games. Applications including bargaining and auctions. Seven-week course.

Econ 8118, Noncooperative Game Theory. (2 cr. Prereq—8117) Solution concepts for noncooperative games in normal form, including Nash and perfect equilibrium and stable sets of equilibria. Extensive form games of perfect and incomplete information, sequential equilibrium, and consequences of stability for extensive form games. Applications including bargaining and auctions. Seven-week course.

Econ 8119, Cooperative Game Theory. (2 cr. Prereq—8104, Math 5616 or equiv or 103) Basics of cooperative game theory, emphasizing concepts used in economics. Games with and without transferable utility; the core, the value, and other solution concepts. Recent results, including potentials, reduced games, consistency, and noncooperative implementation of cooperative solution concepts. Seven-week course.

Econ 8124, History of Economic Thought. (2 cr. Prereq—8104, 8108 or 103) Selected topics, emphasizing development of theoretical topics. Seven-week course.

Econ 8125, History of Economic Thought. (2 cr. Prereq—8124 or 103) Selected topics, emphasizing development of theoretical topics. Seven-week course.

Econ 8181, Advanced Topics in Microeconomics. (2 cr [max 4 cr] Prereq—8104 or 103) Faculty and student presentations based on recent literature. Seven-week course.

Econ 8182, Advanced Topics in Microeconomics. (2 cr [max 4 cr] Prereq—8104 or 103) Faculty and student presentations based on recent literature. Seven-week course.

Econ 8185, Advanced Topics in Microeconomics. (2 cr [max 4 cr] Prereq—8108 or 103) Faculty and student presentations based on recent literature. Seven-week course.

Econ 8191, Workshop in Mathematical Economics. (1-3 cr [max 10 cr] Prereq—8104 or 103) Students conduct research and present papers under faculty supervision.

Econ 8192. Workshop in Mathematical Economics. (1–3 cr [max 10] Prereq—8104 or 103) Students work on research and present papers under faculty supervision.

Econ 8201, Econometric Analysis. (2 cr. Prereq—[8101 or equiv], Math 1272 or equiv, Stat 5102 or 103) Basic linear regression model, its variants. Panel data, censored/truncated regression, discrete choice models. Time series, simultaneous equation models.


Econ 8205, Applied Econometrics. (2 cr. Prereq—Math 4242 or equiv, Econ 8101, Econ 8105, Stat 5101 or 103) Application in research, including classical and Bayesian approaches; formulation, comparison, and use of models and hypotheses; inference and prediction in structural models; simulation methods. Seven-week course.

Econ 8206. Applied Econometrics. (2 cr. Prereq—8205, 10102, 10106, Stat 5101 or 103) Application in research, including classical and Bayesian approaches; formulation, comparison, and use of models and hypotheses; inference and prediction in structural models; simulation methods. Seven-week course.

Econ 8207. Applied Econometrics. (2 cr. Prereq—8206, 10103, 10107, Stat 5102 or 103) Application in research, including classical and Bayesian approaches; formulation, comparison, and use of models and hypotheses; inference and prediction in structural models; simulation methods. Seven-week course.

Econ 8208. Applied Econometrics. (2 cr. Prereq—8207, 10104, 10108, Stat 5102 or 103) Application in research, including classical and Bayesian approaches; formulation, comparison, and use of models and hypotheses; inference and prediction in structural models; simulation methods. Seven-week course.

Econ 8211. Econometrics. (2 cr. Prereq—5151, 5152, Math 4242 or equiv, Stat 5102 or 103) Linear regression, general linear hypotheses; Gauss Markov Theorem, generalized least squares and their applications. Decision-theoretic choice among estimators. Simultaneous equations models; identification and estimation. Asymptotic distribution theory. Applications, including multivariate time series models and/or limited dependent variables models. Seven-week course.

Econ 8212. Econometrics. (2 cr. Prereq—8211) Linear regression; general linear hypotheses; Gauss Markov Theorem, generalized least squares and their applications. Decision-theoretic choice among estimators. Simultaneous equations models; identification and estimation. Asymptotic distribution theory. Applications, including multivariate time series models and/or limited dependent variables models. Seven-week course.

Econ 8213. Econometrics. (2 cr. Prereq—8212) Linear regression; general linear hypotheses; Gauss Markov Theorem, generalized least squares and their applications. Decision-theoretic choice among estimators. Simultaneous equations models; identification and estimation. Asymptotic distribution theory. Applications, including multivariate time series models and/or limited dependent variables models. Seven-week course.

Econ 8218. Advanced Topics in Econometrics. (2 cr. Prereq—8207, 8213 or 104) Faculty and student presentations based on recent literature. This is a 7-week course.

Econ 8222. Advanced Topics in Econometrics. (2 cr. Prereq—8213 or 104) Faculty and student presentations based on recent literature. Seven-week course.

Econ 8291. Workshop in Econometrics. (1–3 cr [max 10 cr]) Prereq—8213 or 104) Faculty and student presentations based on recent literature. Seven-week course.

Econ 8292. Workshop in Econometrics. (1–3 cr [max 10 cr]) Prereq—8212 or 104) Methods of analyzing dynamical systems; applying methods to new models of growth and development; deriving and evaluating models’ quantitative implications in light of growth and development in a number of countries. Seven-week course.

Econ 8312. Economic Growth and Development. (2 cr. Prereq—8311 or 104) Methods of analyzing dynamical systems; applying methods to new models of growth and development; deriving and evaluating models’ quantitative implications in light of growth and development in a number of countries. Seven-week course.

Econ 8313. Economic Growth and Development. (2 cr. Prereq—8312 or 104) Methods of analyzing dynamical systems; applying methods to new models of growth and development; deriving and evaluating models’ quantitative implications in light of growth and development in a number of countries. Seven-week course.

Econ 8333, FTE: Master’s. (1 cr. Prereq—Master’s student, adviser and DGS consent)

Econ 8381. Advanced Topics in Economic Development. (2 cr [max 4 cr] Prereq—8312 or 104; offered when feasible) Faculty and student presentations based on recent literature. Seven-week course.

Econ 8382. Advanced Topics in Economic Development. (2 cr [max 4 cr] Prereq—8313 or 104) Faculty and student presentations based on recent literature. Seven-week course.

Econ 8391. Workshop in Economic Growth and Development. (1–3 cr [max 10 cr]) Prereq—104) Faculty and student presentations based on recent literature. Seven-week course.

Econ 8392. Workshop in Economic Growth and Development. (1–3 cr [max 10 cr]) Prereq—104) Faculty and student presentations based on recent literature. Seven-week course.


Econ 8402. International Trade and Payments Theory. (2 cr. Prereq—8401 or 104) Tariffs, quotas, and other barriers to trade; gains from trade; trading blocs; increasing returns; growth. This is a seven-week course.

Econ 8403. International Trade and Payments Theory. (2 cr. Prereq—8402 or 104) International business cycles; exchange rates; capital movements; international liquidity. This is a 7-week course.

Econ 8404. International Trade and Payments Theory. (2 cr. Prereq—8402, 8403 or 104) Theoretical models of international trade. Trade data, empirical work on trade. Seven week course.

Econ 8444, FTE: Doctoral. (1 cr. Prereq—Doctoral student, adviser and DGS consent)

Econ 8481. Advanced Topics in International Trade. (2 cr [max 4 cr] Prereq—8403 or 104) Faculty and student presentations based on recent literature. Seven-week course.

Courses
Courses

**Econ 8482. Advanced Topics in International Trade.** 2 cr (max 4 cr. Prereq–8403 or #) Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8491. Workshop in Trade and Development.** 1-3 cr [max 10 cr. Prereq–#]

**Econ 8492. Workshop in Trade and Development.** 1-3 cr [max 10 cr. Prereq–#]

**Econ 8501. Wages and Employment.** 2 cr (Prereq–8102, 8106 or #) Economic analysis of labor markets and their operation under conditions of both individual and collective bargaining. Implications of labor market operations for resource allocation, wage and price stability, income and employment growth. Wage structures and wage levels. Wage and employment theories and practices. Economic impacts of unions. Seven-week course.

**Econ 8502. Wages and Employment.** 2 cr (Prereq–8501 or #) Economic analysis of labor markets and their operation under conditions of both individual and collective bargaining. Implications of labor market operations for resource allocation, wage and price stability, income and employment growth. Wage structures and wage levels. Wage and employment theories and practices. Economic impacts of unions. Seven-week course.


**Econ 8581. Advanced Topics in Labor Economics.** 2 cr (max 4 cr. Prereq–8502 or #) Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8582. Advanced Topics in Labor Economics.** 2 cr (max 4 cr. Prereq–8503 or #) Faculty and student presentations based on recent literature. Seven-week course.


**Econ 8808. Advanced Topics in Public Economics.** 2 cr (max 4 cr. Prereq–8803 or #) Faculty and student presentations based on recent literature. Seven-week course.

**Econ 8888. Thesis Credit: Doctoral.** 1-24 cr [max 100 cr. Prereq–Max 18 cr per semester or summer; 24 cr required]

**Econ 8891. Workshop in Public Economics and Policy.** 1-3 cr [max 10 cr. Prereq–#]

**Econ 8892. Workshop in Public Economics and Policy.** 1-3 cr [max 10 cr. Prereq–#]

**Econ 8899. Individual Graduate Research.** 1-7 cr [max 7 cr. Prereq–#]

**Education (Educ)**

**College of Education and Human Development**

**Educ 8333. FTE: Master’s.** 1-3 cr (Prereq–Master’s student, adviser and DGS consent)

**Educ 8444. FTE: Doctoral.** 1-3 cr (Prereq–Doctoral student, adviser and DGS consent)

**Educ 8866. Doctoral Pre-Thesis Credits.** 1-18 cr [max 60 cr. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed preliminary oral]

**Educ 8777. Thesis Credits: Master’s.** 1-18 cr [max 50 cr. Prereq–Max 18 cr per semester or summer; 10 cr total required (Plan A only)]

**Educ 8888. Thesis Credit: Doctoral.** 1-24 cr [max 100 cr. Prereq–Max 18 cr per semester or summer; 24 cr required]

**Education and Human Development (EdHD)**

**College of Education and Human Development**

**EdHD 5001. Learning, Cognition, and Assessment.** 3 cr. [SPSF 3119. Prereq–MEd/initial licensure student or CLA music ed or preteaching major or #; psych course recommended] Principles of learning, cognition, cognitive development, classroom management, motivation, instruction, assessment. Approaches include behaviorism, cognitive and social constructivism, human information processing theory. Topics include intelligence, knowledge acquisition, reasoning skills, instructional achievement, standardized testing, reliability, validity, student evaluation, performance assessment, portfolios, demonstrations. Applications to instruction and organization of curricular materials.

**EdHD 5003. Developmental and Individual Differences in Educational Contexts.** 3 cr. [A-F only. Prereq–Post-bac or MEd/initial licensure or CLA music ed or preteaching major or FGE or agriculture or kinesiology or #] Overview of developmental and individual differences of children and adolescents in educational contexts; emphasis on a dynamic systems perspective; developmental transitions in childhood and adolescence; interactions between the student, environment, and task; and accommodations and adaptations for students in special education.

**EdHD 5005. School and Society.** 2 cr (A-F only. Prereq–MEd/initial licensure student or CLA music ed major or preteaching major or instr approval) Readings in history, philosophy, social sciences, and law revealing diverse educational values in a pluralistic society. Multiple expectations of schools. Civil liberties, rights, community. Varying cultural backgrounds of students, family circumstances, exceptional needs.