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Courses

Course Numbers, Symbols, and Abbreviations

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/schedule/html/tc.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. Course descriptions for 4xxx, 6xxx, and 7xxx courses can be found online at <www.semesters.umn.edu/tc/>.

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.
A-F, S-N, NGA ... Grading options. NGA means “no grade associated.” If no grading option is listed, the course may be taken either A-F or S-N. For more information about grading, see page 14.

The courses in this catalog are current as of March 20, 2003.
Check the University Catalogs Web site at <www.catalogs.umn.edu> 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 2050, [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 mgmt 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 8330 or 8130, [mgmt or grad mgmt student]) Introduction to the U.S. federal system of taxation. Concepts of gross income, deductions, and credits. Analysis of the structure of the Internal Revenue Code and its provisions with respect to specific areas of the law. Examination of the interrelationships between legislative, judicial and administrative authority. Introduces the various 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 mgmt grad student) Theory underlying the preparation of consolidated financial statements, as well as the mechanical computations needed to prepare the statements themselves.

Acct 5200. Tax Accounting Methods and Periods. (4 cr; A-F only. Prereq–MGT student; 5135) Rules affecting timing of income and deductions for tax purposes. Examination of cash and accrual accounting methods on an overall basis and with respect to individual items of income and deductions; rules for changing accounting methods and periods; annual accounting and transactional concepts, including the claims of right doctrine, the Arrowsworth doctrine, and the tax benefit rule.

Acct 5220. Tax Research, Communication, and Practice. (4 cr; A-F only. Prereq–MGT student; 5135) In-depth treatment of tax research methodology including tax questions, locating potential authority, assessing potential authority, and communicating research results. Substantive material on dealing with the IRS including sources of IRS policy; processing returns, auditing returns; rulings and determination letters; closing agreements; assessments and collections.

Acct 5230. Corporate Taxation I. (2 cr; A-F only. Prereq–MGT student; 5135) Federal income taxation of corporations and shareholders. Organization of a corporation; establishment of its capital structure; determination of its tax liability; dividends and other nonliquidating distributions; stock redemptions, and liquidations.

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–5102, acct major) Topics vary.

Acct 5325. Advanced Tax Principles. (2 cr; A-F only. Prereq–5135, MBT student) In-depth coverage of issues affecting all tax entities, focusing on topics pertaining to individuals and partnerships: at-risk provisions, passive activity loss rules, Alternative Minimum Tax/AMT credit for individuals, tax benefit rule and claim of right doctrine, like-kind exchanges of personal property, net operating losses, hobby losses, and business/rental use of residences.

Acct 5330. Taxation of Corporations I. (2 cr; A-F only. Prereq–5230, MBT student) Corporate reorganization and related to multiple corporations and consolidated returns.

Acct 5333. Tax Aspects of Consolidated Returns. (2 cr; A-F only. Prereq–5230, MBT student) Covers aspects of filing consolidated federal income tax returns. Includes determining affiliated groups; election and filing requirements; intercompany transactions, limitations on certain loss and credit carryforwards; allocation of federal income tax liability; E&P and investment basis adjustments; loss allowance rules; and excess loss accounts.

Acct 5335. Taxation of the Small Business Corporation. (2 cr; A-F only. Prereq–5230, MBT student) Federal income taxation of S corporations. Election eligibility; termination of status; treatment of income and deduction items; distributions, basis of stock and debt. Compensation arrangements in closely held corporations; fiscal year issue; personal service corporations; advantages of C corporations vs. S corporations; corporation liquidation and redemption rules; S corporation’s built-in gains tax.

Acct 5340. Taxation of Partnerships and Partners. (2 cr; A-F only. Prereq–5135, MBT student) Reviews tax consequences associated with formation, operation, and dissolution of a partnership.

Acct 5350. Taxation of Estates and Gifts. (2 cr; A-F only. Prereq–5135, MBT student) Taxation of transfers under federal estate and gift tax laws. Includes property owned by the decedent; retained life estates; transfers taking effect at death; revocable transfers; joint interest; powers of appointment; valuation problems; expenses, debts and taxes; charitable bequests, reduction, taxable inter vivos gifts, splitting and credits.

Acct 5351. Estate Planning. (2 cr; A-F only. Prereq–5135, MBT student) Addresses various topics related to planning the transfer of property during lifetime and at death.

Acct 5353. Income Taxation of Fiduciaries. (2 cr; A-F only. Prereq–5135, MBT student) Simple, complex, and revocable trusts; estates; accumulation distributions, income in respect of decedents; trust accounting income and principal; distributable net income; terminations; and excess distributions.

Acct 5356. Taxation of Compensation Arrangements. (2 cr; A-F only. Prereq–5135, MBT student) Federal income taxation of corporate deferred compensation and fringe benefits, emphasis on pension plans, profit sharing plans, stock option plans, individual retirement accounts, annuities and insurance, medical related compensation benefits, and reporting requirements.

Acct 5360. State and Local Taxation. (2 cr; A-F only. Prereq–5135, MBT student) Examines state levying of individual income, corporate income, property, sales, and excise taxes. Tax problems of businesses with multistate operations.

Acct 5370. Taxation of Property Transactions. (2 cr; A-F only. Prereq–5135, MBT student) Determining realized gain or loss and recognized gain or loss, and tax treatment of that gain or loss on property dispositions. Consequences of property transactions including depreciation, depletion, basis, and capital gains problems.


Acct 5381. Tax Aspects of International Business II. (2 cr; A-F only. Prereq–5380, MBT student) Foreign tax credit and Subpart F planning opportunities, international structuring (including joint ventures and use of the new entity classification regulations), transfer pricing, and foreign currency. Recent legislative, regulatory, and judicial developments in the international tax area, and the challenges and opportunities presented by these developments.


Acct 8802. Emerging Issues in Accounting. (4 cr) Prereq: Business admin PhD student or A offered alt yrs
Topics vary.

Acct 8811. Information Economics I. (4 cr. Prereq: Business admin PhD student or A offered alt yrs)
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 admin PhD student or A offered alt yrs)
Information in capital markets; asset pricing with asymmetric information; economics of disclosure and information acquisition.

Acct 8821. Experimental Economics. (4 cr. Prereq: Business admin PhD student or A offered alt yrs)
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 admin PhD student or A offered alt yrs)
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 admin PhD student or A)
Readings approved to 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 admin PhD student or A)
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)
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 provide 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 5196. Field Experience in Adult Education. (3 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)
Definitions and history; workplace, community and family. Issues: poverty, welfare, ethnicity, cultural diversity, social class, language and learning, immigrants. Review of literacy programs, funding, and evaluation. Emphasis on social justice. Setting educational goals; formal versus informal assessment; case studies; educational planning.

AdEd 5202. Assessment of Adult Literacy. (3 cr)
Assessment of adult literacy problems as they affect work, family and community. Setting educational goals; formal versus informal assessment; case studies; educational planning.

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

AdEd 5301. Survey of Distance Education. (3 cr)
Survey of distance education concepts, theory, history, present practice, delivery systems, course design, major issues, and future directions.

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 5611. Futurism in Human Resource Development and Adult Education. (3 cr)
Implications of future developments in areas of theory/practice in human resource development and adult education.

AdEd 5612. Managing and Consulting in Human Resource Development and Adult Education. (3 cr. Prereq: 5001W or HRD 5001W)

AdEd 5700. Special Topics in Adult Education. (1-8 cr [max 12 cr])
Exploration of issues, methods, and knowledge in areas of adult education. Content varies.

AdEd 8001. Advanced Theory in Human Resource Development and Adult Education. (3 cr; A-F only, Prereq: 5001 or HRD 5001)
Theoretical understanding of individuals and organizations as adaptive entities; roles of human resource development and adult education in mediating complex demands.

AdPy 5515. Neuropsychology: University Hospitals. (3-9 cr)
AdPy 8205. Special Assignments. (1-16 cr)
AdPy 8206. Research. (1-16 cr)
AdPy 8249. Clinical NeuroPsychoPharmacology. (1-15 cr. Prereq: Resident status or 3rd- or 4th-yr med student or 8248 for grad students)
The course is designed for a two-day presentation, four hours one afternoon, followed by eight hours the next day, to include the following subject matter: introduction to neurotransmitter theory and mechanism of action of psychotropic drugs; evaluation of anxiety states and use of anti-anxiety agents; clinical picture of depression, use of antidepressants, and principles of drug combinations; schizophrenia diagnosis, use of antipsychotic drugs, antiparkinson medication, parkinson side effects of neuroleptics, and tardive dyskinesia; clinical evaluation of epilepsy and use of anticonvulsants; neurophysiology of sleep, description of hypnotics and sedatives, and significance of over-the-counter sleep aids; use of anorexants, over-the-counter appetite suppressants, and opiate analgescics; gastrtic psychopharmacology; classification of drug side effects and principles of drug interaction; abused drugs; and ethnopsychopharmacology.

AdPy 8970. Directed Studies. (1-24 cr)

Aerospace Engineering and Mechanics (AEM)

Department of Aerospace Engineering and Mechanics
Institute of Technology

AEM 5401. Intermediate Dynamics. (3 cr. Prereq: IT upper div or grad, 2012, Math 2243)
Three-dimensional Newtonian mechanics, kinematics of rigid bodies, dynamics of rigid bodies, generalized coordinates, holonomic constraints, Lagrange equations, applications.

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, vorticity; 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 8000. Seminar: Aerospace Engineering and Mechanics. (1 cr [max 4 cr]; S-N only, Prereq: DGS consent)

AEM 8201. Fluid Mechanics I. (3 cr. Prereq: 4201 or equiv, Math 2263 or equiv)
Mathematical and physical principles governing the motion of fluids. Kinematic, dynamic, and thermo-dynamic properties of fluids; Bernoulli’s theorem; fluid motion; 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: 8202)
Analysis of compressible flow and shock waves; method of characteristics for one-dimensional unsteady flow and for two-dimensional steady flow.

AEM 8207. Hydrodynamic Stability. (3 cr. Prereq: 8201)

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 vortex structures in mixing layers and boundary layers; horseshoe vortices; flow visualization.

AEM 8230. Fluid Mechanics IV. (3 cr. Prereq: 8203)
Analysis of boundary layer flows, heat transfer, turbulence.
Courses

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 8501 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 8231. Physical Gas Dynamics. (3 cr; Prereq–4201 or equiv, 4203 or equiv, ME 3324 or equiv) Molecular and macroscopic effects in gas flows. Use of collision theory to determine mean free path, velocity distributions; statistical mechanics; partition function; Maxwellian and Boltzmann distributions; nonequilibrium flows; applications in rarefied and hypersonic flows.

AEM 8241. Perturbation Methods in Fluid Mechanics. (3 cr; Prereq–8202 or #) Method of matched asymptotic expansions presented through selected 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–4201 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–5001) Theory of kinematic, hyperbolic, and dispersive waves, with application 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; NGA; Prereq–Master’s student, adviser and DGS consent) Seminar: Dynamical Systems and Controls. (1 cr; max 4 cr; N-S only) Developing program of research in dynamical systems/controls. 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 analysis of linear systems. Linear quadratic gaussian (LQG) and eigenstructure assignment design methodologies. Topics in H∞. Applications.

AEM 8411. Advanced Dynamics. (3 cr; Prereq–5401 or equiv or #) Lagrange’s equations; calculus of variations and Lagrange multipliers, kinematics and dynamics of rigid bodies, and Hamilton’s principle; applications to discrete and continuous systems.

AEM 8412. Nonlinear Systems. (3 cr; Prereq–8411) Introduction to nonlinear dynamical systems. Method of averaging and its applications; Liapunov stability, center manifold, and normal form theories; bifurcation analysis; introduction to chaotic phenomena.

AEM 8413. Advanced Nonlinear Systems. (3 cr; Prereq–8412) Dynamical systems with emphasis on higher dimensional (more than three) systems and global and chaotic phenomena. Bifurcation analysis with codimension greater than one, Melnikov method, and Silnikov phenomena. Concepts of symmetry. Application to problems modeled by partial differential equations.

AEM 8421. Robust Multivariable Control Design. (3 cr; Prereq–8411 or equiv) Application of robust control theory to aerospace systems. Role of model uncertainty/modeling errors in design process. Control analysis and synthesis, including H∞ and H∞ optimal control design and structural singular value techniques.

AEM 8426. Optimization and System Sciences. (3 cr; A-F only; Prereq–8401, IT grad student) Applications of modern finite dimensional optimization techniques in system/control theory. Linear/nonlinear programming, duality; complexity theory, interior point methods, matrix inequalities, convex optimization over cones, bilinear matrix inequalities, rank-constrained problems.

AEM 8431. Trajectory Optimization. (3 cr; Prereq–4311 or equiv or #) Parameter optimization problems. Topics in calculus of variations; necessary conditions of nonlinear optimal control problems; classification of trajectory optimization algorithms; steady-state aircraft flight; minimum-time climb aircraft trajectory; aerodynamic orbit transfer trajectories; optimal space trajectories.

AEM 8444. FTE: Doctoral. (1 cr; NGA; Prereq–Doctoral student, adviser and DGS consent) Thesis Credits: Doctoral. (1-24 cr; max 100 cr; NGA; Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

AEM 8533. Thesis Credits: Master’s. (1-18 cr; max 50 cr; NGA: Max 18 cr per semester or summer; 10 cr total required [Plan A only]) Includes 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, miminization, 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–4581 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 tensorial theories; 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; 3-D continuum formulation, yield surfaces, hardening rules, and material stability; slip line theory, Prandtl punch solution; single crystal plasticity.


AEM 8595. Selected Topics in Mechanics and Materials. (1-4 cr; max 8 cr; Prereq–#) Includes individual student projects completed under guidance of a faculty sponsor.

AEM 8601. Finite Element Methods in Computational Fluid Mechanics. (3 cr; Prereq–#) Fundamental concepts and techniques of finite element analysis. Variational equations and Galerkin’s method; weak formulations for problems with nonsymmetric differential operators; Petrov-Galerkin methods; examples from solid and fluid mechanics; properties of standard finite element families, implementation.


AEM 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; NGA: 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]; NGA: Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only]) Includes individual student projects completed under guidance of a faculty sponsor.

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

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

African American and African 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 5143. Geography of West Africa. (3 cr) West Africa from Senegal to Cameroon. Social geography of resource use, population, settlement, economic development, and international relations.

Afro 5145. Development in Africa. (3 cr) Economic, political, and social development in Africa from independence to the present, emphasizing the reordering of colonial landscapes, bases for North-South relations, big power interventions, and participation in the world economy.

Afro 5181. Blacks in American Theater. (3 cr) 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 Theater: 1960 to Present. (3 cr) 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 5348] 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. Prereq—[African American or African Studies] major or minor, #) Supervised field study/internship focused on African American or African cultural(s), language(s), and development.

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

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 cansons of history to analyze and critique oral traditions and integrate them into written history.

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

Afro 5597. Seminar: Harlem Renaissance. (3 cr) 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) 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 the Mass Media. (3 cr; A-F only. Prereq—Jour major or minor, Jour 2004, A) Analysis of relationships between mass media and communities of color in the United States. Focuses on issues of content and control.

Afro 5756. Social History of Blacks in Sports. (3 cr) Social/cultural contexts surrounding eras of athletes such as Jack Johnson, Jackie Robinson, Joe Louis, Jesse Owens, Atheia 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. Prereq—#) 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 9 cr) 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, naion, and class.

Afro 8590. 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.

Courses

Agricultural, Food, and Environmental Education (AFEE)

Department of Work, Community, and Family Education

College of Education and Human Development

AFEE 5111W. 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 programs 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.

AFEE 5235. Advanced Supervised Agricultural Experience Programs. (2 cr) The organization and administration of agricultural experience programs for middle and secondary level students: career exploration, improvement projects, experiments, placement in production/business/community settings, entrepreneurship. Current state and national programs and resource material.
AFEE 5237. Mentorship for Supervising Agricultural Educational Technology or Teaching. (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) Reflection, analysis on current problems and issues confronting beginning teachers of agricultural education. Issues in teaching methods, classroom and program management, discipline, curriculum, FFA and SAE development, school-to-work relationships.


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

AFEE 5331. 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) 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) 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 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 5993. Directed Study in Agricultural Education and Extension. (1-9 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) 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—Ag ed 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) Prereq—Ag ed student doing Plan B research. 1) Select problems, prepare bibliographies, analyze and interpret data, and prepare manuscripts on studies.

Agricultural Engineering Technology (AgET)

Department of Biosystems and Agricultural Engineering

College of Agricultural, Food and Environmental Sciences

AgET 5095. Special Problems in Biosystems and Agricultural Engineering. (1-5 cr; Prereq—Ag) Individual study project in biosystems and agricultural engineering at advanced level. Application of engineering principles to a specific problem.

AgET 5203. Environmental Impacts of Food Production. (3 cr) Topics include crop production intensity, animal raising options, food processing waste alternatives, and pest control.

AgET 5212. Safety and Environmental Health Issues in Plant and Animal Production and Processing. (3 cr; A-F only) Prereq—Grad student or [jr or sr in [COAFES or IT or education or public health or nursing]] Safety/health issues in food production, processing and horticultural work environments using public health, injury control, and health promotion frameworks: regulation, engineering, education. Traumatic injury, occupational illness, ergonomics, pesticide health effects, biotechnology, air contaminants.

AgET 5999. Special Workshop in Biosystems and Agricultural Engineering. (1-4 cr; Prereq—Ag) Workshops on a variety of biosystems and agricultural engineering topics offered at locations other than the Twin Cities campus. See Class Schedule or department for current offerings.

Agronomy and Plant Genetics (Agro)

Department of Agronomy and Plant Genetics

College of Agricultural, Food and Environmental Sciences

Agro 5021. Introduction to Plant Breeding. (3 cr; Prereq—GCB 1022 or equiv) Prereq—Stat 5021 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 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 sessions 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 AnSc 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 only. Prereq—Ag) 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) Prereq—Stat 5301 or equiv) Principles and current methods involved in breedng agronomic and horticultural crops. Use of genotypic/phenotypic 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—Agro 8201, Stat 5301, math 5303 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, translocations. Aneuroploid, autopolyploid, allopolyploid, and uses of cytogenetic tools in molecular and classical genetics and plant breeding.

Agro 8241. Molecular and Cellular Genetics of Plant Improvement. (3 cr; Prereq—GCB 5034 or equiv or #) Principles of genetic modification of higher plants by application of molecular and cellular biotechnology.
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-N only, Prereq—4 or #)

Topics in American Sign Language (ASL): form/function, vocabulary production, grammatical features needed by professionals working with children, storytelling strategies, technical sign language for graduate students, Content progresses in repeated segments.

American Studies (AmSt)

Department of American Studies
College of Liberal Arts

AmSt 5101. Religion and American Culture. (3 cr; A-F only)

AmSt 5202. Thought and Practice of American Religions. (4 cr; Prereq—4 or #)

American studies of American as fields of inquiry, including its history, major theoretical framework, and interdisciplinary methodologies.
Courses

AmSt 8970. Independent Study in American Studies. (1-3 cr. [max 9 cr]; Prereq–#) Independent study of interdisciplinary aspects of American civilization under guidance of faculty members of various departments.

Ancient Near Eastern (ANE)

Department of Classical and Near Eastern Studies

College of Liberal Arts


ANE 5502. Ancient Israel: From Conquest to Exile. (3 cr. 3502, 3502, 35502. Prereq–Hebrew not required; 5501 recommended) Israelite history in context of what is known from Egyptian, Canaanite, and Mesopotamian sources. Focus on issues raised by archaeological data related to Israelite conquest of Canaan.


ANE 5504. History and Development of Israelite Religion II. (3 cr) Ancient Judaism from the Persian restoration (520 B.C.E.) to Roman times (2nd century C.E.). Religious, cultural, and historical developments are examined to understand Jewish life, work, and worship under a succession of foreign empires: Persian, Greek, and Roman.


ANE 5713. Introduction to Ugaritic. (3 cr. Prereq–Adv Hebrew, previous study of biblical texts or #) Ugaritic alphabetic cuneiform script, morphology, and syntax. Reading of representative samples of Ugaritic literature. Attention to linguistic and cultural issues and links to biblical and other Ancient Near Eastern texts.

ANE 5993. Directed Studies. (1-4 cr. Prereq–#, A, #) Guided individual reading or study.

Anesthesiology (Anes)

Department of Anesthesiology

Medical School


Anes 5588. Advanced Clinical Physiology II for Nurse Anesthetists. (3 cr [max 3 cr]; A-F only. Prereq–5587) Respiratory physiology, acid-base physiology, gastrointestinal physiology, metabolism, endocrinology, reproductive physiology, physiology of pregnancy/labor.

Anes 5686. Chemistry and Physics for Nurse Anesthetists. (3 cr; A-F only. Prereq–General chemistry or #) Chemical equilibrium, organic chemistry, physics of fluids/gases, anesthetic applications.


Animal Science (AnSc)

Department of Animal Science

College of Agricultural, Food and Environmental Sciences


AnSc 8111. Genetic Improvement of Animals. (3 cr. Prereq–#) 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 8131. Molecular Biology Techniques in Animal Science. (3 cr; A-F only. Prereq–Bioi 3332, 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. Prereq–Grad student or prof school student or #) 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 proper conduct. Societal impact on scientific investigations utilizing animal subjects.

AnSc 8141. Current Topics in Animal Breeding and Genetics. (1 cr [max 2 cr.; Prereq–5200 or MVB 5200 or EEB 5033]) Students pursue independent research. Topics vary depending on current research needs.

AnSc 8194. Research in Animal Genetics. (1-3 cr. Prereq–#) Research in quantitative genetics, cyto genetics, molecular genetics, and other areas related to animal breeding.

AnSc 8211. Animal Growth and Development. (3 cr. Prereq–#) 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. Prereq–#) Research in selected areas.

AnSc 8311. Animal Bioenergetics. (3 cr; A-F only. Prereq–#) 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–Bioi 4331) Basic and applied concepts of protein metabolism in farm animals.

AnSc 8320. Concepts and Developments in Nutritional Physiology. (2 cr [max 4 cr; A-F only. Prereq–#] Review and critical evaluation of pertinent scientific literature.

AnSc 8330. Concepts and Developments in Ruminant Nutrition. (1 cr [max 2 cr; A-F only. Prereq–#] Review and critical evaluation of recent research reports.

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

AnSc 8340. Concepts and Developments in Swine Nutrition. (2 cr [max 4 cr; A-F only. Prereq–#] Review and critical evaluation of scientific literature.


AnSc 8411. Physiology of Reproduction. (3 cr [A-F only. Prereq–3305 or equiv] 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; antigens of semen, ova, and genital secretions; immunopathology; maternal-fetal incompatibility; and antibodies to hormones.

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

AnSc 8451. Reproductive Endocrinology. (2 cr; A-F only. Prereq–3305 or 3327 or equiv, Bioi 3021) Hormonal regulation of mammalian reproductive cycles and seasonal patterns; nutritional and stress effects on reproductive endocrinology; mechanism of hormone action.

AnSc 8494. Research in Animal Physiology. (1-3 cr. Prereq–#) 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–#]) Student presentations of literature, proposals, and research results; instructional guidelines and performance evaluation; preparation of visual material.
Courses

AnSc 8594. Research in Animal Science. (1-3 cr. Prereq–Grad anth major or 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]; NGA. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral) 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.

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

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

Anthropology (Anth)

Department of Anthropology
College of Liberal Arts

Anth 5025W. Cultural Semantics. (3 cr) Understanding cultures and cognitive classification systems through lexical semantics.

Anth 5027W. Origins of European Civilization. (3 cr. §5027) Early development of European society, 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 or #) Advanced introduction to the development of feminist theory in anthropology. Theoretical and methodological shifts in feminist anthropology and ethnography. Feminist ethnography within the discipline as a whole; current debates concerning the reading and writing of ethnography.

Anth 5041. Ecological Anthropology. (3 cr. §5041, §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 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 5128. Anthropology of Learning. (3 cr) Cross-cultural perspectives in examining educational patterns, and the implicit and explicit cultural assumptions underlying them; methods and approaches to cross-cultural studies in education.

Anth 5221. Anthropology of Material Culture. (3 cr; A-F only) 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. (3 cr [max 3 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. (5 cr; A-F only. Prereq–Grad anth major or #) Introduction to foundational 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 recent work in semiotic, psychological, and feminist anthropology.


Anth 8120. Problems in Culture Change and Applied Anthropology. (3 cr; A-F only. Prereq–8001) 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 anth 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. §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. §4021) Self, emotion, cognitive processes, and child development in cross-cultural perspective.

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

Anth 8213. Ecological Anthropology. (3 cr. §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 anth 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 8217. Pedagogy. (3 cr) Introduction to role of teaching in academic culture, active learning and critical thinking styles, learning style differences among students, and development of writing assignments, discussion groups, exams, and lectures that help students develop critical, observational, and integrative abilities most crucial to anthropology.

Anth 8219. Grant Writing. (2 cr. Prereq–Grad anth majors preparing to submit research grant proposals next academic year) 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 8220. Archaeology Field School. (3-9 cr [max 9 cr]; A-F only. Prereq–Grad anth major) Advanced archaeological field excavation, survey, and research. Intensive training in excavation techniques, recording, analysis, and interpretation of archaeological materials.

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/laboratory research management, and fundraising.

Anth 8244. Skeletal Materials for Archaeologists. (4 cr; A-F only. Prereq–#) How anthropologists use fossil bones to answer questions of past human diet, behavior, and environments. Skeletal element and species identification (of humans, large mammals). Students analyze small assemblage of bones for class project. Emphasizes scientific method, data analysis using computers.

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

Anth 8444. FTE: Doctoral. (1 cr. NGA. 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.

AnSc 8666. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; NGA. 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]; NGA. Prereq–Max 18 cr per semester or summer; 10 cr 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 Credits: Doctoral. (1-24 cr [max 100 cr]; NGA. Prereq–Max 18 cr per semester or summer; 24 cr required)

Anth 8991. Independent Study. (1-18 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. Prereq–#)

Anth 8993. Directed Study. (1-18 cr. Prereq–#)

For definitions of course numbers, abbreviations, and symbols, see page 153.
Courses

Applied Economics (ApEc)

Department of Applied Economics
College of Agricultural, Food and Environmental Sciences


ApEc 5151. Applied Microeconomics: Firm and Household. (2 cr. Prereq—Econ 5151 or #) Quantitative techniques for analysis of economic problems of firms and households. Links between quantitative tools and economic analysis developed to understand economic theory and develop research skills. Quantitative tools include regression analysis, mathematical programming, and present value analysis.


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. State and Local Public Services and Finance. (3 cr. A-F only. Prereq—3001 or equiv) The organization, delivery, economic analysis and finance of state and local public services and functions.

ApEc 5401. Price Analysis, Futures, and Options Markets. (3 cr. Prereq—3002 with grade of at least B, Math 1142 or equiv or grad student) Development/application of price models. Unique market institutions in agriculture that have been developed in response to marketing/pricing problems. Futures/options trading. Hedging, speculative uses of futures/options contracts. Price efficiency, market performance/regularities.


ApEc 5511. Labor Economics. (3 cr. Prereq—[3001 or Econ 3011 or PA 5021; PA 5032 or equiv,] grad student) 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; 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—[Sr or grad student] in [biology or science 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 5637. Agricultural Law. (3 cr. Prereq—Sr or grad or #) Economic regulation of agriculture. Industrial organization and market structure in agriculture, public lands and water law, agricultural cooperatives, farm labor, farm finance, crop insurance and disaster assistance, agricultural biotechnology, food and drug law, price and income regulations, and international agricultural marketing.

ApEc 5651. Economics of Natural Resource and Environmental Policy. (3 cr. Prereq—[3101; 4611 or Econ 3611 or NRES 3261WI] or #) Economic analysis of policy evaluation of current natural resource/environmental issues. Emphasizes 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 policy in an open world economy; role of private markets; government in regulating market supply and demand; income vs. price support, supply controls, environmental constraints, and export protectionism; functioning of markets; roles of public interest groups and future of American agricultural policy.

ApEc 5721. Economics of Science and Technology Policy. (3 cr. Prereq—[5151 or 5151, PA 5022 or #] Economics of technical change, research, and technology. Productivity: Methods for evaluating impacts of R&D. Intellectual property rights.


ApEc 5811. Cooperative Organization. (3 cr. Prereq—3001, 3002 or #) Application of economic analysis to the cooperative form of organization. Producer and 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 included.

ApEc 5861. Economics of Agricultural Production. (3 cr. Prereq—5151 or Econ 5151 or #) Production economics applied to agriculture, profitable combination of production factors; comparative advantage and location of production.

ApEc 5891. Independent Study: Advanced Topics in Farm and Agribusiness Management. (1-4 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 regularly offered courses.

ApEc 8202. Mathematical Optimization in Applied Economics. (3 cr. Prereq—[5151, Econ 5151 or equiv 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 8205. Applied Game Theory. (3 cr. A-F only. Prereq—[8101, 8102, 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 8333. FTE: Master’s. (1 cr. Prereq—Master’s student, adviser and DGS consent)


ApEc 8402. Information and Behavioral Economics. (2 cr. A-F only. Prereq—[8401, Econ 8001, Econ 8002] or [Econ 801, Econ 8102] 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.
Courses

Arabic (Arab)

Department of African American and African Studies

College of Liberal Arts

Arab 5001. Research Methods in Arabic Studies. (3 cr) Skills and techniques required to deal with medieval and modern works in Arabic literature and Islam. A survey of the most important research bibliographies of Arabic and Islamic studies. Bibliographic references in English and, when appropriate, Arabic.


Arab 5036. Islam: Religion and Culture. (3 cr. §Afro 3036) Religion of Islam, faith, practices, sectarian splintering, expansion outside original home to status of world religion, institutions, status in world societies—Asia, Europe, Americas.

Arab 5101. Advanced Arabic I. (3 cr. Prereq—3102 or equiv or #) Advanced readings in classical and modern Arabic. Compositions based on texts.

Arab 5102. Advanced Arabic II. (3 cr. Prereq—5101 or #) Readings of Arabic texts. Writing compositions based on texts. Continuation of 5101.

Arab 5491. Classical Islamic Civilization. (3 cr. §Afro 3036) Islamic legacy in the classical age (800-1400), including medical/natural sciences, mathematics, philosophy, literature, and their transmission to Europe.

Arab 5501. Modern Arabic Poetry in Translation. (3 cr) Free verse movement and its major trends: post-romantic, social realist, symbolist, resistance, prose poem. Emphasizes leading poets such as Al-Mala’ika, Al-Sayyab, Al-Bayati, and Amin. Theoretical/critical essays. All readings in English.


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 3542) Peoples, lands, and cultures of the Middle East. Historical survey from earliest civilizations to the present.

Arab 5541. Islam in the Catholic Age: Arab Phase 600 A.D. to 900 A.D. (3 cr. §Arab 3541) The rise of Islam in its Arabian setting. Roles of the prophet, the Orthodox and Umayyad Caliphs. Development of the Islamic state and empire; Status of Muslims and non-Muslims.

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

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

Arab 5544. Arab World: 1920 to the Present. (3 cr. §Arab 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.


Applied Plant Sciences (APSc)

College of Agricultural, Food and Environmental Sciences

APSc 8123. Research Ethics in the Plant and Environmental Sciences. (0.5 cr; S-N only. Prereq—Grad student) Ethics training to graduate students enrolled in plant/environmental graduate research programs and fulfill requirement for training in responsible conduct of research. Course meets during first seven weeks of spring semester.

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

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

APSc 8666. Doctoral Pre-Thesis Credits. (1-18 cr) Special seminars or individual work on subjects suited to needs of students.

Arabic (Arab)

Department of African American and African Studies

College of Liberal Arts

Arab 5001. Research Methods in Arabic Studies. (3 cr) Skills and techniques required to deal with medieval and modern works in Arabic literature and Islam. A survey of the most important research bibliographies of Arabic and Islamic studies. Bibliographic references in English and, when appropriate, Arabic.
Arab 5900. Topics in Arabic Literature and Culture. (3 cr; max 9 cr; Prereq—5102 or #) Readings and discussion of selected works in Arabic. Topics specified in Class Schedule.

Arab 5992. Directed Readings. (1-3 cr; Prereq—#) Individual research and readings for advanced students.

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

Aramaic (Arm)

Department of Classical and Near Eastern Studies

College of Liberal Arts

Arm 5011. Biblical Aramaic and Old Aramaic Inscriptions. (3 cr; Prereq—yr Hebrew or Arabic or #) Biblical Aramaic—grammar, fluency in reading Biblical Aramaic and Old Aramaic inscriptions.

Arm 5012. Syriac. (3 cr; Prereq—yr Hebrew or Arabic or #) Emphasis on fundamentals of grammar and reading Syriac texts fluently.

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 8255, 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 formulation and evaluation. Emphasis on conceptual development, research, and analytic drawing.

Arch 5250. Advanced Topics in Design. (1-6 cr [max 6 cr]; A-F only. Prereq—Arch or #) Advanced topics in design.

Arch 5281. Undergraduate Architecture Studio I. (6 cr; A-F only. Prereq—Arch major or #) Architectural questions in settlement patterns, architectural elements in their formal organization. Mapping techniques, orthographic projections, analytic drawing, models.

Arch 5282. Undergraduate Architecture Studio II. (6 cr; A-F only. Prereq—Arch or #) 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 5283. Undergraduate Architecture Studio III. (6 cr; A-F only. Prereq—Arch or #) Exploration of selected design issue or topic, its influence on organization of material form to create places of human habitation.

Arch 5284. Undergraduate Architecture Studio IV. (4 cr; A-F only. Prereq—Arch or #) Design studio.

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

Arch 5292. Accelerated Undergraduate Architecture Studio II. (6 cr; A-F only. Prereq—[5291, accelerated status] or #) Architectural problems. Emphasizes development of structures as integral part of design, site planning, design process.

Arch 5311. Theory of Architectural Representation. (3 cr; A-F only. Prereq—Arch 5321, 5372, MACIC or #) Integration of emerging computer graphics with photography and architectural graphic conventions. Historical, theoretical, and critical issues of representation. Influence of visual media on architectural field.

Arch 5313. Visual Communication Techniques in Architecture. (3 cr; A-F only. Prereq—For undergrads 3301, BA Arch or BED major; for grads M Arch major or #) Exploration of delineation, presentation, and design techniques, using various visual media and methods of investigation.

Arch 5321. Architecture in Watercolor. (3 cr; A-F only. Prereq—[5311, [Arch or BED]) or M Arch grad student or #) Watercolor as a tool in the design process. Survey of foundation principles, techniques, medium, tools, and materials. Exploration of color relationships, mixing, composition, and applications to design.

Arch 5350. Topics in Architectural Representation. (1-3 cr [max 9 cr]; A-F only. Prereq—Arch 5321, M Arch major or #) Selected topics in architectural representation.

Arch 5351. AutoCAD I. (3 cr; Prereq—For undergrads 5281, arch major; for grads M Arch major or #; may not be taken for graduate credit) Basic concepts, tools, and techniques of computer-aided drawing with current AutoCAD Release. Strategies and techniques for producing dimensioned and annotated drawings suitable for plotting and an introduction to 3-D drawing capabilities. Use of dimension variables, attributes, blocks, symbols, and the creation of customized menus.

Arch 5352. AutoCAD II. (3 cr; Prereq—For undergrads 5351, arch major; for grads M Arch major or #; 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, arch major; for grads M Arch major or #; may not be taken for graduate credit) 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. Prereq—18251, M Arch major or #) Introduction to current techniques, computer programs, and their application to architectural computing.

Arch 5372. Computer Methods II. (1 cr. Prereq—5371, 18252 and M Arch major or #) Current techniques, computer programs, and their application to architectural computing.

Arch 5373. Computer Methods III. (1 cr; C-S only. Prereq—5372, 18253, 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, 18254, M Arch major or #) Advanced computer applications in design, history, theory, representation, and technology.

Arch 5381. Introduction to Computer Aided Architectural Design. (3 cr; A-F only. Prereq—Arch or BED or M Arch or grad student in LA or #) 2-D drawing, 3-D modeling/animation, printing, plotting. Electronic networking/communications, database management, spreadsheet analysis, land-use analysis, project management.

Arch 5382. Computer Aided Architectural Design. (3 cr; A-F only. Prereq—[5381, undergrad, [BA Arch major or BED major] or M Arch major or graduate LA major or #) 2-D/3-D CAD, image manipulation. Advanced multimedia visualization techniques for design, including solid modeling, photo-realistic imaging, animation, video-editing/recording.

Arch 5410. Topics in Architectural History. (3 cr; max 12 cr; A-F only. Prereq—For undergrads 3412, arch major; for grads M Arch major or #) Advanced study in architectural history. Readings, research, and seminar reports.

Arch 5411. Principles of Design Theory. (3 cr; A-F only. Prereq—M Arch major or #) Principles of design and their instrumentation. How and why architecture theory is generated. Types and significance of formal analysis. Theoretical positions and modes of criticism.

Arch 5423. Gothic Architecture. (3 cr; A-F only. Prereq—For undergrads 3411, 3412, arch major; for grads M Arch major or #) History of development of architecture and urban design in Western Europe from 1150 to 1400.

Arch 5424. Renaissance Architecture. (3 cr; A-F only. Prereq—For undergrads 3411, arch major; for grads M Arch major or #) History of architecture and urban design in Italy from 1400 to 1600. Emphasis on major figures (Brunelleschi, Alberti, Bramante, Palladio) and the evolution of major cities (Rome, Florence, Venice).

Arch 5425. Baroque Architecture. (3 cr; A-F only. Prereq—For undergrads 3411, arch major; for grads M Arch major or #) History of the interaction of architecture and nature in Italy, England, and France in the 16th and 17th centuries. Major monuments, their relationship to theories of architecture and gardening, urban and rural life.

Arch 5431W. Eighteenth-Century Architecture and the Enlightenment. (3 cr; A-F only. Prereq—[3411, 3412, undergrad arch major] or M Arch grad student or #) Architecture, urban planning, and garden design in Europe from 1700 to 1850.

Arch 5432. Modern Architecture. (3 cr; A-F only. Prereq—For undergrads 3412, arch major; for grads M Arch major or #) Architecture and urban design in Europe from the early 19th century to World War II.

Arch 5434. Contemporary Architecture. (3 cr; A-F only. Prereq—For undergrads 3412, arch major; for grads M Arch major or #) Developments, theories, movements, and trends in architecture and urban design from World War II to the present.

Arch 5439. History of Architectural Theory. (3 cr; A-F only. Prereq—For undergrads 3412, arch major; for grads M Arch major or #) History of architectural theory from antiquity to the 20th century.

Arch 5450. Topics in Architectural Theory. (1-3 cr [max 9 cr]; A-F only. Prereq—Arch or M Arch major or #) Selected topics in architectural theory and criticism.

Arch 5451. Architecture: Defining the Discipline. (3 cr; A-F only. Prereq—M Arch major or #) Architecture as a discipline: its nature, role, purpose, and meaning discussed within a general, philosophical, and theoretical framework. Investigation and discussion of paradigms defining architectural theory and practice.
Arch 5452. Architecture: Design, Form, Order, and Meaning. (3 cr; A-F only. Prereq–M Arch major or #) Architecture and the issue of meaning. Explores fundamental and constituent elements of architectural form and order; their inherent tectonic, phenomenal, experiential, and normative characteristics; their potential and implications for the creation and structure of meaningful human places.

Arch 5454. Semiotics and Deconstruction in Architecture. (3 cr; A-F only. Prereq–S411, M Arch major or #) Expressive and cultural dimensions of architecture, especially those related to linguistic analogies, knowledge production, and contemporary philosophy. Broad critical perspective of architectural discussion and argumentation addressing current issues.

Arch 5455. Typology and Architecture: Theories of Analysis and Synthesis. (3 cr; A-F only. Prereq–S411, M Arch major or #) Theoretical traditions and development of typology’s role in architecture. Investigates works of Laugier, Quatremere de Quincy, Viollet-Le Duc, Ledoux, Durand, Camillo Sitte, and Le Corbusier. Recent developments and theoretical positions of neo-rational and contextual arguments for contemporary applications of the idea of type.

Arch 5458. Architecture and Culture. (3 cr; A-F only. Prereq–3412, arch major or grad student or #) Architecture as a cultural medium. Relationships among architecture, people, and culture; research findings and development of a similar and high style architecture. Physiological and symbolic messages; reception theory in architecture; cultural critique and change; implications for architectural practice.

Arch 5459. Gender and Architecture. (3 cr. Prereq–Arch or Women’s Studies major or #) Examination of ideas related to gender and architecture, gendered and non-gendered places and practices, and their relations to cultural norms and change.

Arch 5461. North American Indian Architecture. (3 cr. Prereq–For undergrads 3412, arch or AmIn major; for grads M Arch major or #) Historic and contemporary principles and theories of North American Indian architecture. Study of the culture, technology, environment, art and craft of North American Indians in their settlements and architecture.

Arch 5501. Architecture and Ecology. (4 cr; A-F only. Prereq–5281, LA 3501, arch major or #) Introduction to ideas and practices of ecological approaches to architectural design. Ecological context and implications/opportunities of architecture. Historical/ theoretical framework for ecological design thinking. Issues studied at a variety of scales: site/community, building scale, component scale. Fundamental theories, concepts, principles, strategies, and design tools addressed at each scale.

Arch 5511. Construction Materials in Architecture. (3 cr; A-F only. Prereq–M Arch or #) Building materials, assemblies, and construction operations shaping building designs. Material properties for design/detailing of building systems, elements, and components. Implications in design applications. Modeling, hands-on building experiences.

Arch 5512. Building Methods in Architecture. (3 cr; A-F only. Prereq–5511, M Arch major or #) Analysis of architectural materials, building systems, and construction operations related to enclosure systems design, building infrastructure, and detailing. Application of legal constraints and regulations (e.g., ADA, building codes, life-safety issues) in preparation of drawings, specifications, and construction documents for building design.

Arch 5513. Environmental Technology I: Thermal Design in Architecture. (3 cr; A-F only Prereq–M Arch major or #) Thermal and climatic issues in the design of small and mid-size buildings. Investigations in built and mechanical methods to modify climate. Evaluation of the impact of design techniques on energy use, the environment, and architectural meaning.

Arch 5514. Environmental Technology II: Lighting and Acoustic Design. (3 cr; A-F only. Prereq–M Arch major or #) Principles of daylighting, electric lighting, and acoustic design in architecture. Relationship between luminous and acoustic environments, human comfort and architectural experience. Analytical methods, design process, and modeling of daylighting.

Arch 5525. Design in Masonry. (3 cr; A-F only. Prereq–5512, M Arch major or #) Design principles, construction methods, and document production for masonry structures.

Arch 5539. Daylighting and Architecture Design. (3 cr; A-F only. Prereq–5514, M Arch major or #) Role of daylighting in architectural design: principles, strategies, energy and environmental issues, psychology of light, color, and integration of electric lighting. Design projects investigate qualitative and quantitative issues through drawing, physical models, and photometric analysis.


Arch 5550. Topics in Technology. (1-3 cr [max 6 cr]) Prereq–#) Selected topics in architecture technology, including construction, environmental management, energy performance, lighting, or materials.

Arch 5561. Building Production Processes. (3 cr. Prereq–5282, 5501, arch major or BEED major or M Arch major or #) Introduction to design-build processes including document production, contract execution, and building project management. Case study and hands-on experiences examine construction industry organization, scheduling, consultant relations, legal and code restraints, contractual stipulations, budget and project resource allocations.


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, structural glass, and structural tensile 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. Prereq–Grad–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 projects.

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 grads M Arch major or #) Fundamentals of real estate development and investment building. Processes and rules of specialists in development of investment properties. 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. Prereq–5621, 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. Prereq–Arch or M Arch major or #) Selected topics in the theory, philosophy, 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–3412, 5672 or #) Philosophy, theory, and methods of historic building research, descriptive analysis of buildings, building documentation, historic archaeology, and architectural taxonomy.

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

Arch 5724. Meanings of Place. (3 cr; A-F only. Prereq–Arch or BED or Geog major or M Arch or LA grad major or #) Analysis of meanings and messages of surroundings, and examination of links between sense of place and feelings of well-being. Exploration of what present-day environments can reveal about the past. Survey of Twin Cities’ central district and selected neighborhoods, and other settings inside and outside Minnesota.

Arch 5750. Topics in Urban Design. (1-3 cr; A-F only. Prereq–5711, M Arch or LA grad major or #) Special topics in theory and practice of urban design.

Arch 5993. Directed Study. (1-4 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; A-F only. Prereq–Grad arch major or #] For definitions of course numbers, abbreviations, and symbols, see page 153.
Courses

Art 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.


Art 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.

Art 5110. Advanced Drawing. (4 cr. max 12 cr.) Prereq–3101 or 3111 or #) Developing personal direction in form/content. Various media. Various aesthetic/conceptual approaches.

Art 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.


Art 5310. Advanced Sculpture: Direct Metal. (4 cr. max 12 cr.) Prereq–3101 or #) Direct metal sculpture in steel, other metals. Studio practice, investigation of historical/contemporary methods/concepts. Development of personal sculptural imagery.

Art 5320. Advanced Sculpture: Spatial Problems. (4 cr. max 12 cr.) Prereq–3102 or #) Sculptural practice outside traditional media/approaches. Installation, theater, public art, architecture as topics for individual investigations into spatial organization.

Art 5330. Advanced Sculpture: Metal Casting. (4 cr. max 12 cr.) Prereq–3102 or #) Metal casting of sculpture in bronze, iron, aluminum, other metals. Studio practice, investigation of historical/contemporary methods/concepts. Development of personal sculptural imagery.


Art 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.


Art 5403. Women’s Images and Images of Women. (3 cr. 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.


Art 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.

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


Art 5550. Advanced Papermaking. (4 cr. max 12 cr.) Prereq–3503 or #) Distinguish expressive qualities of handmade paper, its versatility as a contemporary art form. Independent research pursued in consultation with instructor.


Art 5620. 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.

Art 5630. 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. Compositing 2-D animation with video.

Art 5640. 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.


Art 5810. Advanced Ceramics. (4 cr. max 12 cr.) Prereq–3801, 3802 or #) Critical discourse of aesthetics, history, and contemporary issues in clay and criticism. Independent, advanced projects.

Art 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.
Courses

ArtS 5380. Advanced Ceramics: Mold Making. [4 cr (max 12 cr); Prereq–Art 3803 or #)]
Advanced mold fabrication, ceramic production, contemporary methods/concepts. Development of personal visual expression.

ArtS 5480. Advanced Neon. [4 cr (max 12 cr); Prereq–Art 3803 or #)]
Emphasis on the development of personal sculptural sensibility. Studio practice with neon glass tubing and electrical components. A mixed media approach is encouraged.

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

Art 8100. Drawing and Painting: Theory and Practice. [3 cr (max 12 cr); Prereq–Art MFA student] 
Tutorial in drawing and/or painting.

Art 8300. 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.

Art 8333. FTE: Master's. [1 cr; NGA. Prereq–Master's student, adviser and DGS consent]

Art 8400. Theoretical Constructions in Contemporary Art. [3 cr (max 6 cr)]

Art 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 teaching strategies. Required of drawing and painting students.

Art 8410. Studio Critique. [3 cr (max 6 cr); A-F only; Prereq–Art 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.

Art 8500. 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.

Art 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.

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

Art 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 8990. M.F.A. Creative Thesis. [1-9 cr (max 18 cr); Prereq–Art MFA candidate, passed oral/written prelim, #]
Research/studio work in preparation for thesis exhibition and supporting paper.

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/ critique visual presentations through Web pages.

Arth 5103. Hellenistic and Early Roman Art and Archaeology. [3 cr; Prereq–Arth 3008, Jr or grad or #)]
Sculpture, architecture, painting, and topography in developing centers of Hellenistic culture in the eastern Mediterranean, and in Etruscan and Roman towns from 400 BC to the beginnings of the Roman Empire.

Arth 5108. Greek Architecture. [3 cr; Prereq–Arth 3008, Jr 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; Prereq–Arth or grad 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–Jr or Sr or grad or #]
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.

Arth 5120. Field Research in Archaeology. [3-6 cr (max 6 cr); Prereq–#)]
Field excavation, survey, and research at archaeological sites in the Mediterranean area. Techniques of excavation and exploration; interpretation of archaeological materials.

Arth 5172. House, Villa, Tomb: Roman Art in the Private Sphere. [3 cr; Prereq–Intro art history 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; Prereq–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–Jr or Sr or grad or #]
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 5253. History of Early Christian Art in Context. [3-4 cr; Prereq–Arth 412 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 inst consent] 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 5324. 15th-Century Painting in Northern Europe. [3 cr; Prereq–Jr or Sr 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; Prereq–One course in ancient art/archaeology or #)
Methods for excavation of Old/New World sites. Meets one archaeology lab for part of the semester and at selected site in Minnesota for day-long sessions for 9 to 10 weeks.

Arth 5347. 17th- and 18th-Century Art of Northern Europe. [3 cr; Prereq–3011 or grad student or #]
Seventeenth-century painting in Holland/Belgium (e.g., Rembrandt, Rubens). Seventeenth-century Northern European art, especially eighteenth-century French architecture, sculpture, and painting (e.g., Versailles, Poussin, Watteau).

Arth 5417. Twentieth Century Theory and Criticism. [3 cr; Prereq–3464 or #]
Trends in 20th-century art theory, historical methodology, criticism. Key philosophical ideas of modernism/postmodernism: formalism, semiotics, poststructuralism, feminism, Marxism, psychoanalysis, deconstruction.

Arth 5431. Age of Revolution: French Painting 1789 to 1870. [3 cr]
Major issues and movements in France and leading practitioners: neo-classicism-David; romanticism-Corot, Gericault, Delacroix; landscape and peasant painting-the Barbizon group; realism-Courbet; pre-Impressionism-Monet, Manet, Pissarro. Movements linked with historical changes emphasizing contextualization of monuments.

Arth 5454. Design Reform in the Era of Art Nouveau. [3 cr]
History of art nouveau in France, Belgium, England, Germany, Austria, Scotland, United States. Innovations in architecture, graphics, decorative arts; continental variants of the style. Major promoters and pioneers of modern design. Critical issues of design reform; texts integrated with principal monuments.

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

Arth 5465. American Sculpture: The Public Monument. [3 cr]
Case studies in American public sculpture of the 19th and 20th centuries including the 1893 Chicago Fair, the Iwo Jima and Vietnam Veterans Memorials, the Washington Monument, the Lincoln Memorial; careers of Daniel Chester French and Augustus St. Gaudens.

Arth 5466. Contemporary Art. [3 cr; Prereq–3464 or #]
Survey of the art and important critical literature of the period after 1970. Origins and full development of postmodern and subsequent aesthetic philosophies.

Arth 5521. Modernism and Modernity in American Painting: 1876 to 1945. [3 cr]
Relationship between modernity and “modernism” in the visual arts between the Centennial Exposition of 1876 and World War II. Artists addressed include the Ash Can School and the Regionalists.

Arth 5535. Style, Tradition, and Social Content in American Painting: Colonial Era to 1876. [3 cr]
America’s colonial, Revolutionary era, and 19th-century painters’ responses to the influence of European aesthetics. Key American painting types:
Courses

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) 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. “high” architecture, 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 art from the late tomb period to the modern era; special attention to the development of indigenous traditions.

ArtH 5769. 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; Preq–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; A-F only) 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 5994. Directed Research. (1-4 cr [max 12 cr]; A-F only. Prereq–#)

ArtH 8001. Art Historiography: Theory and Methods. (3 cr; A-F only) Key texts, from Renaissance to present, from western/ non-western fields, relating to history/criticism of both art and visual culture. Focuses on recent critical theory, its re-examination of assumptions underlying the discipline.

ArtH 8190. Seminar: Issues in Ancient Art and Archaeology. (3 cr [max 12 cr]; Prereq–#) Selected topics, with special attention to current scholarly disputes. Topics specified in Class Schedule.

ArtH 8200. Seminar: Medieval Art. (3 cr [max 12 cr]) Focus on a major art historical theme, artist, period, or genre.


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

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

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 changing American relationships at the turn of the 20th century.

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

ArtH 8520. Seminar: American Art and Material Culture. (3 cr [max 12 cr]; 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]; NGA. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

ArtH 8710. Seminar: Islamic Art. (5 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 history.
Ast 8021. Stellar Astrophysics. (4 cr. Prereq.—4 cr.
Stellar structure, evolution, and star formation. Emphasizes contemporary research.

Ast 8031. Astrophysical Fluid Dynamics. (4 cr. Prereq.—4 cr.
Contemporary topics. Numerical techniques for modeling astrophysical fluids and plasmas. Supranova shocks, convection, astrophysical jets, and cloud dynamics.

Ast 8041. Comparative Planetology. (4 cr. Prereq.—4 cr.
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.—4 cr.
Content, structure, evolution, and dynamics of Milky Way Galaxy. Emphasizes recent observations from space-ground-based telescopes.

Ast 8061. Radio Astronomy. (4 cr. Prereq.—4 cr.

Ast 8071. Infrared Astronomy. (4 cr. Prereq.—4 cr.

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

Ast 8110. Topics in Astrophysics. (2-4 cr. Prereq.—4 cr.
Unnatural number.

Ast 8120. Topics in Astrophysics. (2-4 cr. Prereq.—4 cr.
Unnatural number.

Ast 8200. Astrophysics Seminar. (1-3 cr. Prereq.—4 cr.

Ast 8333, FTE: Master's. (1 cr; NGA. Prereq-Master's student, adviser and DGS consent)

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

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

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

Ast 8888, Thesis Credits: Doctoral. (1-24 cr; max 100 cr.; NGA. Prereq-Max 18 cr per semester or summer; 24 cr required)

Ast 8990. Research in Astronomy and Astrophysics. (1-4 cr. Prereq. Undergraduate standing)

Research under supervision of a graduate faculty member.

Biochemistry (BioC)
Department of Biochemistry, Molecular Biology, and Biophysics
College of Biological Sciences and the Medical School

BioC 5001. Biochemistry, Molecular and Cellular Biology. (5 cr. S6001. Prereq-Undergraduate course in biochemistry or #)
Integrated course in biochemistry, molecular biology, cell biology, and developmental biology.
BioC 5309. Biocatalysis and Biodegradation. (3 cr. S5309. Prereq-Chemistry through organic chemistry: knowledge of word processing, e-mail, access to World Wide Web, access to college-level science library recommended)
Assess validity of information on biocatalysis and biodegradation; learn fundamentals of microbial catalytic metabolism as it pertains to biodegradation of environmental pollutants; biocatalysis for specialty chemical synthesis; display of this information on the Web.

BioC 5352. Applied Microbial Biochemistry. (3 cr. 5352. Prereq-Biol/BioC 3021 or BioC 4331 or 4311, McIb 3301 or Biol 3301 or #)
Biochemistry of microorganisms and enzymes of industrial interest. Heterologous peptide overproduction by microorganisms and yeasts; polymer, antibiotic, organic acid, and amino acid production; genetics of industrially useful microorganisms; biological systems useful for biotransformation and environmental remediation; introduction to fermentation technology.

BioC 5361. Microbial Genomics and Bioinformatics. (3 cr. Prereq-College-level course in (organic chemistry, biochemistry, microbiology))
Introduction to genomics. Emphasizes microbial genomics. Sequencing methods, sequence analysis, genomics databases, genome mapping, prokaryotic horizontal gene transfer, genomics in biotechnology, intellectual property issues.

BioC 5401W. Advanced Metabolism and Its Regulation. (3 cr. Prereq-3021 or 4331 or Biol 3021)
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. S5444. Prereq-Biol/BioC 3021 or BioC 3023 or Biol 301 or #)
Muscle structure/function: molecular mechanism by which force is generated.

BioC 5446. Membrane Biochemistry. (2 cr. Prereq-3021 or 4331 or Biol 3021)
Membrane structure. Mechanisms and physiological roles of channels, pumps, and membrane enzymes.

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 5528. Spectroscopy and Kinetics. (4 cr. Prereq-[Intro biochemistry, intro physics] or chemical physics or #)
Biochemical dynamics from perspectives of kinetics and spectroscopy. Principles of nuclear magnetic resonance (NMR) and X-ray crystallography.

BioC 5530. Selected Topics in Molecular Biophysics. (1-3 cr; max 9 cr.; NGA. Prereq-Max 18 cr per semester or summer; 10 cr total required [Plan A only])
Unnatural number.

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 #)
Macromolecular crystallography for protein structure determination/engineering. Determining macromolecule structure by diffraction.

BioC 5532. Macromolecular Crystallography II: Techniques and Applications. (1-5 cr. S-N only. Prereq-5531)
Determination of structures of macromolecules by diffraction. Using software in macromolecular crystallography.

BioC 8001. Advanced Biochemistry I: Protein Structure, Function, and Metabolism. (4-5 cr. Prereq-[One sem biochem, two sems organic chem, one sem physical chem] or #)
Protein structure, methods to determine structure, protein folding, forces stabilizing macromolecular structure, protein engineering, design. Dynamic properties of proteins/enzymes, enzyme substrate complexes, mechanism of enzyme catalysis. Enzymology of metabolic regulation and cell signaling.

BioC 8002. Molecular Biology and Regulation of Biological Processes. (4 cr. Prereq-BMBB & MCDBBG & grad student or #)

BioC 8007. Cell Biology and Biochemistry of the Extracellular Matrix. (3 cr; A-F only. S5MPP 8007. Prereq—BIOB 8002 or MIM B 8004 or #)

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

BioC 8184. Graduate Seminar. (1 cr; max 5 cr; S-N only. Prereq—Grad BMBB major or DGS consent)
Unnatural number.

BioC 8213. Selected Topics in Molecular Biology. (4 cr. S5GCD 8213. Prereq—BIOB 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 splicings, initiation/control of translation, animal viruses, transposable elements, somatic recombination, oncogenes.

BioC 8216. Signal Transduction and Gene Expression. (4 cr. Prereq—BIOB 8002 or #)
Cell signaling, metabolic regulation in development. Procaryotic/eucaryotic 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 or #)
Research project carried out in laboratory of a staff member.

BioC 8333, FTE: Master's. (1 cr; NGA. 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.

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

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

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

BioC 8888, Thesis Credits: Doctoral. (1-24 cr; max 100 cr.; NGA. Prereq-Max 18 cr per semester or summer; 24 cr required)
Courses

Bioinformatics (Binf)
Department of Laboratory Medicine and Pathology
Medical School

Binf 5480. Bioinformatics Journal Club. (1 cr; max 12 cr; S-N only)
Bioinformatics Journal Club

Binf 5490. Topics in Bioinformatics. (1-6 cr; max 12 cr; Prereq–Independent or group study in bioinformatics.

Biology (Biol)
College of Biological Sciences

Biol 5407. Ecology. (3 cr; §3407. Prereq–[1101 or 1009 or equiv.] Math 1142 or Math 1271 or equiv, grad or #)
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.

Biol 5409. Evolution. (3 cr; §3409. Prereq–[1001 or 1009], grad or #)
Diversity of forms in fossil record and in presently existing biology. Genetic mechanisms of evolution. Examples of ongoing evolution in wild/domesticated populations and in disease-causing organisms. Lab.

Biol 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 of research on teaching. Opportunities for students to practice and evaluate teaching strategies.

Biol 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 K-12 teachers depending on topics or subtopics which might include any of the following: plant biology, animal biology, genetics, cell biology, biochemistry, microbiology.

Biol 5913. Biology for Teachers: Monarchs in the Classroom. (3 cr. Prereq–[Elementary or middle school or high school or preschool] 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 (BMEn)
Biomedical Engineering Institute of Technology

BMEn 5001. Advanced Biomaterials. (3 cr; A-F only. Prereq–3301 or MatS 3011 or grad student or #)
Commonly used biomaterials. Chemical/physical aspects. Practical examples from the 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.

BMEn 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, vessel, and cartilage; regulation of biomaterials and engineered tissues.

BMEn 5101. Advanced Bioelectricity/Instrumentation. (3 cr. Prereq–Phsl 5440, calculus physics)
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.

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

BMEn 5201. Biomedical MEMS. (4 cr; A-F only. Prereq–Analog circuit principles, basic electromagnetic theory)

BMEn 5202. Advanced Biomechanics. (3-4 cr. Prereq–[IT upper div or grad student], AEM [statics, deformable media] or #)

BMEn 5311. Advanced Biomedical Transport Processes. (3-4 cr. Prereq–IT upper div or grad student or #)

BMEn 5351. Cell Engineering. (3 cr. Prereq–5301 or equiv, 5310 or equiv, 5201 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. Prereq–Phsl 3061, Phsl 3071, Phsl 5061)
Overview of physiology underlying thermoregulation in humans, clinical applications of heat transfer in humans, framework for design project.

BMEn 5444. Muscles. (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 division 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)
Special topics.

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

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

BMEn 8401. New Product Design and Business Development. (4 cr; A-F only. 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. Prereq–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; NGA. 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; 5-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; NGA. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

BMEn 8710. Directed Research. (1-3 cr)

BMEn 8720. Internship in Biomedical Engineering. (3 cr; max 3 cr; 5-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; NGA. Prereq–Max 18 cr per semester or summer; 10 cr total required [Plan A only])

BMEn 8820. Plan B Project. (3 cr; max 3 cr.) Prereq–BMEn MS student
Project chosen by student and adviser to satisfy M.S. Plan B project requirement. Written report required.

BMEn 8888. Thesis Credits: Doctoral. (1-24 cr; max 100 cr; NGA. Prereq–and 18 cr per semester or summer; 24 cr required)

BMEn 8900. 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 in consultation with faculty supervisor. Requires approval by faculty supervisor and director of graduate studies.

Biomedical Science (BMSC)
Medical School

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

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

Biophysical Sciences (BPhy)

School of Physics and Astronomy

Institute of Technology and Medical School

BPhy 513B. Research Seminar. (1 cr (max 4 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 5170. Basic Radiological Physics. (3 cr. Prereq----)
Theoretical/experimental aspects of radiological physics. Physical properties of various ionizing radiations, interactions of ionizing radiations with matter, methods of radiation dose measurement.

BPhy 5171. Medical and Health Physics of Imaging I. (3 cr. Prereq--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 5172. Radiation Biology. (3 cr. Prereq--5170 or #)

BPhy 5173. Medical and Health Physics of Radiation Therapy. (3 cr. Prereq--5170 or #)

BPhy 5174. Medical and Health Physics of Imaging II. (3 cr. Prereq--5170 or #)

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 8148. Advanced Digital Imaging Science. (3 cr. Prereq--5171 or #)

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

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

BPhy 8333. FTE: Master's. (1 cr; NGA. Prereq--Master's student, adviser and DGS consent)

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

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

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

BPhy 8888. Thesis Credits: Doctoral. (1-24 cr (max 100 cr); NGA. Prereq--Max 18 cr per semester or summer; 24 cr required)

Biosystems and Agricultural Engineering (BAE)

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

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

BAE 5513. Watershed Engineering. (3 cr. Prereq--3023, upper div IT)
Application of engineering principles to managing surface runoff from agricultural, rural, and urban watersheds. Design of facilities and selection of land use practices for controlling surface runoff to mitigate problems of flooding and degradation of surface-water quality.

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 equiv)
Organization/critique 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)
Moderate and critique seminars in biosystems and agricultural engineering.

BAE 8005. Supervised Classroom or Extension Teaching Experience. (2-6 cr. S-N only. §Agro 8005, §Short 8005, §PPIa 8005, §Soil 8000. Prereq--)
Teaching experience is offered in the following departments: Biosystems and Agricultural Engineering; Agronomy 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 8012. Parameter Estimation in Biosystems and Agricultural Engineering. (3 cr. A-F only. Prereq--Stat 3021 or equiv, computer programming course)
Procedures for estimating parameter values and parameter uncertainty from experimental data. Values and interpretation of linear and nonlinear models using ordinary and weighted least-square methods. Design of experiments. Application to biosystems and agricultural engineering problems.

BAE 8094. Advanced Problems and Research. (2-6 cr. Prereq--5095)

BAE 8303. Machinery Modeling. (3 cr. Prereq--AE 2021, CE 3502)
Machinery systems modeling using multidbody dynamics simulation software (MBS). Students review models presented in the literature and report on limitations of modeling approaches used. Models are developed in the students' areas of interest.

BAE 8333. FTE: Master's. (1 cr; NGA. Prereq--Master's student, adviser and DGS consent)

BAE 8444. FTE: Doctoral. (1 cr; NGA. Prereq--Doctoral student, adviser and DGS consent)

BAE 8513. Hydrologic Modeling of Small Watersheds. (3 cr. Prereq--CE 3502, hydrology course)
Study and representation of hydrologic processes by mathematical models: stochastic meteorological variables, infiltration, overland flow, return flow, evapotranspiration, and channel flows. Approaches for model calibration and evaluation.

BAE 8523. Coupled Heat, Moisture, and Chemical Transport in Porous Media. (3 cr. A-F only. Prereq--CSci 3501 or equiv, Math 5512-5513 or equiv, Soil 5232 or equiv, computer programming course)
Series of five projects to develop computer programs to solve governing equations.

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

BAE 8703. Managing Water in Food and Biological Systems. (3 cr. Prereq--Chem 3501 or FScN 5451 or MatS 3011 or #)
Qualitative and quantitative analysis of water in foods and biological materials using NMR and MRI. Water and chemical reactivity, microbial activity, physiochemical properties and changes, and structural properties and changes in foods and biological materials.

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

BAE 8888. Thesis Credits: Doctoral. (1-24 cr (max 100 cr); NGA. Prereq--Max 18 cr per semester or summer; 24 cr required)

Business Administration (BA)

Curtis L. Carlson School of Management

BAE 8444. FTE: Doctoral. (1 cr; NGA. Prereq--Doctoral student, adviser and DGS consent)

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

BAE 8888. Thesis Credits: Doctoral. (1-24 cr (max 100 cr; NGA. Prereq--Max 18 cr per semester or summer; 24 cr required)

Business and Industry Education (BIE)

Department of Work, Community, and Family Education

College of Education and Human Development

BIE 5001. Teaching Marketing Promotion. (3 cr. A-F only)
Materials, methods, and approaches to teaching marketing promotion. Covers the basic elements of the marketing mix: advertising, promotion, public relations, direct selling, visual merchandising, and direct marketing.

BIE 5011. Introduction to Computer Applications. (3 cr)
Instructional uses of computers and representative business/marketing education applications, including word processing, databases, spreadsheets, and graphics.

BIE 5012. Advanced Word Processing. (3 cr. Prereq--5011 or equiv)
Develop/apply solution methods for office problems and computing techniques, including word processing, databases, spreadsheets, and business/marketing education applications, including word processing, databases, spreadsheets, and graphics.

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Courses

BIE 5013. Spreadsheet Analysis Using Computers. (3 cr; Prereq–5011 or equiv) Using spreadsheets to analyze data, monitor business records, and create models.

BIE 5014. Database Computer Applications. (3 cr; Prereq–5011 or equiv) Business needs for computerized databases. Using database software to develop, maintain, and prepare reports.

BIE 5015. Integrated Computer Applications in Business and Marketing Education. (3 cr; Prereq–5011, 5012, 5013, 5014 or equiv) Realistic business computer problems requiring integration of two or more application packages. Pedagogical issues of learning/teaching advanced computer applications.

BIE 5080. Special Topics in Business and Industry Education. (1-4 cr [max 4 cr]) Content varies by offering.

BIE 5101. Technological Problem Solving. (3 cr; A-F only. Prereq–3111, 3112, 3121, 3122) Capstone technology education course in which students research problems relative to various technological systems and develop solution(s) to the identified problems.

BIE 5151. Technical Development: Specialized. (1-12 cr [max 12 cr]; A-F only. Prereq–#) Students select/study technical processes/principles based on subjects they plan to teach, integrate specialized technical instruction in advanced/emerging areas.

BIE 5321. Vocational Guidance in Business and Industry Education. (2 cr; A-F only) Self assessment, use of occupational and labor market information, job seeking skills, work and work satisfaction. For industrial teachers and trainers in school and industry settings.

BIE 5325. Foundations of Industrial Education. (3 cr) Social, economic, psychological, philosophical, legislative, and pedagogical foundations of industrial education in the United States. Comparison with selected foreign countries. Analysis of contemporary trends against backdrop of early foundations.

BIE 5344. Facilities Management in Business and Industry. (3 cr; A-F only. Prereq–3112) Planning, evaluating, and managing industrial education shop and lab facilities.

BIE 5365. Curriculum Development in Technology Education. (3 cr) Conceptualization and derivation of content for the K-12 technology curriculum. Comparison of U.S. approaches to technology curriculum with selected countries.

BIE 5440. Business and Industry Observation and Seminar. (1-3 cr [max 6 cr]) Current operating practices and career opportunities in business and industry. Planned experiences in work environments and related seminars.

BIE 5452. Methods of Teaching Business and Marketing Concepts. (3 cr; A-F only) Recent research/developments in teaching business concepts related to economics, business organization/management, business law, entrepreneurship, marketing, international business, information systems, accounting, risk management, and personal finance.

BIE 5457. Methods of Teaching Business Employment and Marketing Employment. (3 cr; A-F only) Recent research/developments in teaching for business employment. Administrative support positions, accounting/information processing, marketing, sales, computer operations, other occupations using desktop computing.

BIE 5463. Methods in Teaching Keyboarding and Word Processing. (2 cr; A-F only) Implementing keyboarding and word processing: effective teaching strategies; expected learner outcomes; evaluation methods; selecting hardware; instructional materials (including print, software, Internet); organizing and managing labs.

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–#) 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–#) 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) Training competent customer service employees as part of a marketing strategy. Explore training strategies using the appropriate instructional methods for different situations and settings.

BIE 5625. Technical Skills Training. (3 cr; A-F only) 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) 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) 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. Prereq–5011 or equiv) Designing, creating, and presenting information using multimedia for business training applications.


BIE 5796. Field Based Projects in Business and Industry. (1-4 cr [max 4 cr]; S-N only) Current, instructional, developmental, or evaluative projects and problems 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 8995. Research Problems: Business and Industry. (3-6 cr [max 6 cr]; S-N only. Prereq–Adviser 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 5088. 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]) 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 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 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 Healing and Strength. (3 cr; A-F only. Prereq–Jr or sr or grad student or #) Influence of spirituality on resolving conflict, making peace in intense interpersonal/intrapersonal conflicts in multiple health care, social work settings.

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/sectarian 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; A-F only. 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 the ability to enter a state of calm, meditative 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/peoples 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, microcosm, macrocosm. Development of herbal medicine, Tu Na, Qi Gong, acupuncture, moxibustion. Traditional Chinese medicine etiology of disease, physiology, diagnosis, therapy, disease prevention, ethics, ethnomedical, cosmology.

CSpH 5315. Traditional Tibetan Medicine: Ethics, Spirituality, and Healing. (2 cr. 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 5321. Introduction to International Health. (2 cr. 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 care providers who work abroad or with refugee communities in countries of resettlement.

CSpH 5325. Latinos: Culture and Health Perspective. (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 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 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 efficacy. Botanical characteristics, traditional uses, chemical properties, dosage, hazards/safety issues, quality control.


CSpH 5502. Clinical Aromatherapy II. (2 cr. Prereq–5501) Additional applications of clinical aromatherapy, including chemical basis for therapeutic effects, clinical use of 14 essential oils.

CSpH 5511. Interdisciplinary Palliative Care: An Experiential Course in a Community Setting. (2 cr) Multidisciplinary student teams partner with interdisciplinary community hospice teams in delivery of care to patients in a variety of settings. Series of seminars employs self-analysis/case studies.

CSpH 5521. Therapeutic Landscapes. (3 cr. Prereq–Jr or sr or grad student) [in health sciences or therapeutic recreation or horticulture or landscape architecture] or health professional or #) Principles of therapeutic design for specific population requirements. Therapeutic landscape design. Incorporates interdisciplinary interaction between horticulture, landscape architecture, and health science departments.

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 energetic systems in the body to enhance the body’s ability to heal. Scientific theories. Students interact with practitioners and have the opportunity to experience feeling “energy.”

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 5555. Introduction to Body and Movement-based Therapies. (2 cr. Prereq–Jr or sr or grad student or #) Theories/approaches of selected somatic therapies, including dance, movement, and body-based therapies. Historic/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 #) Music therapy, music medicine, music psychotherapy, Techniques/interventions, hypotheses/related to clinical work. Student teams work in patients’ environment.

CSpH 5611. Healthy Humor. (1-6 cr [max 12 cr]) 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.
Courses

Chemical Engineering (ChEn)

Institute of Technology


ChEn 5221. Introduction to Polymer Chemistry. (3 cr; A-F only. PreReq.–3502, Chem 2302 or #) Condensation, addition, radical, ionic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.

ChEn 5302. Chemical Reaction Engineering and Catalysis. (3 cr; A-F only. PreReq.–ChEn 4102) Continuous and batch reactors, heat management, catalytic reactions and reactors, nonideal flow in reactors, polymerization, solids processing, multiphase reactor design. Fundamentals and mechanisms of catalytic reactions. Industrial examples in petroleum/chemical industries.


ChEn 5595. Special Topics. (1-4 cr; PreReq.–#) New or experimental special topics.

ChEn 5751. Biochemical Engineering. (3 cr; A-F only. PreReq.–4002, 4403, 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.–8010) Introduction to food processing as it interfaces with engineering. Case studies. Engineering economics and practical design problems in food processing. Heat transfer; freezing (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.–8010) 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 8010. Fluid Mechanics I: Change, Deformation, Equations of Flow. (3 cr; A-F only. PreReq.–4002 or #) Equations of change of mass, momentum, angular momentum, etc. Kinematics of deformation and convective transport. Applications to fluid statics and dynamics of Newtonian fluids. Examples of exact solutions of Navier-Stokes equations and useful simplifications.

ChEn 8012. Principles and Applications of Rheology. (3 cr; A-F only. PreReq.–8010) 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, application of rheology to polymer processing.


ChEn 8014. Coating Process Fundamentals. (3 cr; A-F only. PreReq.–#) Basic process functions: viscous flow and rheology, capillarity, and wetting; electrostatic effects; phase change, colloidal transformations, mass and heat transfer in drying; kinetics in curing; stress and property development in solidification. Requires independent study and a report.

ChEn 8021. Applied Mathematics I: Linear Analysis. (3 cr; A-F only. PreReq.–#) Integrated approach to solving linear mathematical problems (linear algebraic equations and linear ordinary and partial differential equations) using theoretical and numerical analysis based on linear operator theory. Appropriate for first-year engineering graduate students.

ChEn 8022. Applied Mathematics II: Nonlinear Analysis. (3 cr; A-F only. PreReq.–#) Nonlinear mathematical problems (nonlinear ordinary and partial differential equations) using theoretical and numerical analysis. Appropriate for students who have had a graduate-level course in linear analysis.

ChEn 8301. Physical Rate Processes I: Transport. (3 cr; A-F only. PreReq.–#) Survey of mass transfer, dilute and concentrated solutions, diffusion, Brownian motion. Diffusion coefficients in solutions of Navier-Stokes equations and useful simplifications.

ChEn 8302. Physical Rate Processes II: Mass Transfer. (3 cr; A-F only. PreReq.–8301) Applications of mass transfer. Membranes, including gas separation and reverse osmosis; controlled drug release; dispersion, including examples of pollution control modeling; adsorption and chromatography; coupled heat and mass transfer, including cooling towers; double-diffusive effects.

ChEn 8333. FTE: Master’s. (1 cr; NGA. PreReq.–Master’s student, adviser and DGS consent)

ChEn 8401. Physical and Chemical Thermodynamics. (3 cr; A-F only. PreReq.–#) Principles of classical thermodynamics and an introduction to nonequilibrium thermodynamics, with applications in chemical engineering and materials science. Background should include undergraduate engineering or chemistry courses in thermodynamics.

ChEn 8402. Statistical Thermodynamics and Kinetics. (3 cr; A-F only. PreReq.–Physical–Chemical thermodynamics course) Introduction to statistical mechanical description of equilibrium and non-equilibrium properties of matter, emphasizing fluids and classical statistical mechanics.

ChEn 8444. FTE: Doctoral. (1 cr; NGA. PreReq.–Doctoral student, adviser and DGS consent)

ChEn 8501. Chemical Rate Processes: Analysis of Chemical Reactors. (3 cr; A-F only. PreReq.–#) Design of reactors for heat management and with catalytic processes through detailed analysis of steady state and transient behavior. Polymerization, combustion, solids processing, and environmental modeling: design of multiphase reactors. Primarily for graduate students who have had a course in chemical reactor engineering.

ChEn 8502. Process Control. (3 cr; A-F only. PreReq.–4601 or equiv) For linear systems: stability, controllability, observability, pole-placement via state feedback state observers, output feedback. 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 rate processes course) Description and 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], NGA. PreReq.–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)


ChEn 8777. Thesis Credits: Masters. (1-18 cr [max 50 cr], NGA. PreReq.–Max 18 cr per semester or summer; 10 cr required (Plan A only)

ChEn 8888. Thesis Credits: Doctoral. (1-24 cr [max 100 cr], NGA. PreReq.–Max 18 cr per semester or summer; 24 cr required)

ChEn 8900. Seminar. (1 cr; S-N only) Presentation and discussion of papers concerning new developments in chemical engineering, materials science, and related fields.
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 methods: absorption, emission, 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 8157. Bioanalytical Chemistry. (2 cr; A-F only. Prereq—4101 or equiv, BioC 3021 or equiv) Theory and practical aspects of analytical methods used in detection and characterization of biologically important materials. Enzymatic and kinetic methods in study of proteins, carbohydrates, lipids, and nucleic acids.

Chem 8159. Nuclear Magnetic Resonance Spectroscopy. (4 cr. Prereq—Sen of organic chem) Detailed understanding of relaxation processes, chemical exchange, quadrupolar effects, NMR, NMR hardware, and solid state NMR. NMR imaging and Pulsed Field Gradient (PGP) NMR are discussed.

Chem 8180. Special Topics in Analytical Chemistry. (2-4 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. Prereq—[4701, 3502] or #) Crystal 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 8211. Physical Chemistry of Polymers. (4 cr, 5Mats 8211; Prereq—Undergrad physical chem course or #) Introduction to polymer physical chemistry. Chain conformations; thermodynamics of polymer solutions, blends, and copolymers; 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. 5Mats 5221; Prereq—[2302, 3501] or #) Condensation, radical, ionic, emulsion, ring-opening, metal-catalyzed polymerizations. Chain conformation, solution thermodynamics, molecular weight characterization, physical properties.

Chem 8280. Special Topics in Materials Chemistry. (2-4 cr. 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 8322. Advanced Organic Chemistry. (4 cr. Prereq—[2302 or equiv] Modern studies. Topics, which vary by year, include natural products, heterocycles, asymmetric synthesis, organometallic chemistry, and polymer chemistry.

Chem 8333. FTE: Master's. (1 cr; NGA. Prereq—Master's student, adviser and DGS consent)

Chem 8352. Physical Organic Chemistry. (4 cr. Prereq—5011 or 8011 or 2032 or equiv) Fundamental concepts and mechanistic tools for understanding/analyzing organic reaction mechanisms. Solvation, reactive intermediates, gas phase chemistry, photochemistry, strained-ring chemistry.

Chem 8361. 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. Prereq—Grad chem major or #) Topics (and availability) vary by year depending on instructor and development of the field.

Chem 8411. Bioorganic Chemistry. (4 cr. Prereq—[2302 or equiv]) Chemistry of amino acids, peptides, proteins, lipids, carbohydrates, and nucleic acids; structure, nomenclature, synthesis, and reactivity; an overview of techniques used to characterize these biomolecules.

Chem 8412. Enzyme Mechanisms. (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 oligonucleotide synthesis, antisense approaches, ribozymes, overview of techniques used in nucleic acid research, interactions with small molecules and proteins.

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

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


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

Chem 8601. Seminar: Modern Problems in Chemistry. (1 cr; S-N only. Prereq—Grad chem major or #) Weekly seminar series on modern chemical topics.

Chem 8602. Seminar Presentation: Modern Problems in Chemistry. (1 cr; A-F only. Prereq—Grad chem major or #) Weekly seminar series on modern chemical topics presented by students.

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


Chem 8715. Physical Inorganic Chemistry. (4 cr. Prereq—[4701 or equiv], 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. Prereq—8715, 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); NGA. Prereq—Max 18 cr per semester or summer; 10 cr total required [Plan A only])

Chem 8780. Special Topics in Inorganic Chemistry. (2-4 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. Prereq—Grad chem major or #) Topics (and availability) vary depending on instructor and development of the field.

Chem 8888. Thesis Credits: Doctoral. (1-24 cr; max 100 cr); NGA. Prereq—Max 18 cr per semester or summer; 24 cr required)
Child and Adolescent Psychiatry (CAPy)
Department of Psychiatry
Medical School

CAPy 5620. Disruptive Behavioral Disorders I: Attention Deficit Hyperactivity Disorder Throughout the Life Span. (1 cr)

CAPy 5621. Workshop: Eating Disorders in Children and Adolescents. (1 cr)

CAPy 5623. Treatment Interventions With Anxiety and Depression in Children and Adolescents. (1 cr)

CAPy 5624. Eating Disorders in Children and Adolescents: Medical and Psychological Perspectives. (1 cr; A-F only)
Clinical characteristics of anorexia, bulimia nervosa in children/adolescents. Etiological factors, multidimensional treatment approaches.

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

CAPy 5628. Workshop: Developmental Disorders: Perspectives on Etiology, Assessment, and Treatment. (1 cr)

CAPy 5629. Disruptive Behavioral Disorders IV: Medication and Behavioral Therapies. (1 cr)

CAPy 5630. Workshop: Psychotherapy in Children and Adolescents. (1 cr)

CAPy 5631. Workshop: Developmental Neuropsychiatry. (1 cr)

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

CAPy 5633. Assessment of Anxiety and Depressive Disorders in Children and Adolescents. (1 cr)

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

CAPy 5635. Workshop: Disruptive Behavioral Disorders V. (1 cr)
Theoretical basis, therapy outcome research literature related to CBT. Problem-solving techniques, verbal self-instruction training, attributional retraining, stress inoculation procedures applied to common problems experienced by disruptive children/adolescents. Anger/frustration management, conflict resolution, interpersonal problem-solving, self-esteem enhancement, negative feeling/thought management. Lectures, readings, supervised field experience. Take-home exam.

CAPy 5636. ADHD Throughout the Life Span: Perspectives on Diagnosis, Assessment, and Developmental Course. (1 cr)
ADHD, 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 5661. Aggression, Disruption, and Oppositional Behavior in Children and Adolescents. (1 cr)
Principles of applied behavioral analysis. Specific behavioral programs adapted for treatment of children’s aggressive, disruptive, and oppositional behavior. Applications to home/school setting.


CAPy 5663. Building Friendships and Peer Relationship Skills: Interventions for Socially Rejected Children. (1 cr)
Basic milestones in social development. Behaviors/mechanisms leading to peer acceptance/rejection during childhood. Strategies for promoting social skill acquisition. Behavioral, social-cognitive, and emotional-regularization intervention approaches.

CAPy 5665. Innovative Methods in Psychotherapy. (1 cr)
CAPy 5666. Methods of Measurement and Assessment in Psychopathology. (1 cr)
CAPy 5645. Workshop: Innovative Methods in Psychotherapy. (1 cr)
CAPy 5646. Workshop: Methods of Measurement and Assessment in Psychopathology. (1 cr)
Behaviors/mechanisms related to peer rejection. Social skills interventions for promoting positive relationships and for building meaningful friendships.

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 5650. Disruptive Behavioral Disorders VI: Behavioral Management Interventions. (1 cr)

CAPy 5652. Summer Practicum on Cognitive-Behavioral Therapies for Children and Adolescents. (1 cr)

CAPy 5653. Introduction to Play Therapy. (1 cr)

CAPy 5654. Summer Practicum in Prevention Science II: Building Friendships and Peer Relationship 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.
Courses

CPsy 5666. Aggression and Conduct Problems in Children and Adolescents. (3 cr)

CPsy 5667. Child-Focused Interventions for Aggression and Conduct Problems in Children and Adolescents. (1 cr)
Practices of intervention for practitioners who work in school, community, clinical, and other service delivery sectors where children with aggression/conduct problems end up being served. Overview of problems. Three areas of child-focused interventions.

CPsy 5668. Parent and Family Interventions for Aggression and Conduct Problems in Children and Adolescents. (1 cr)

CPsy 5669. Attention Deficit Hyperactivity Disorder Throughout the Life Span: Current Perspectives on Treatment. (1 cr)

CPsy 5670. Preventing Violence and Antisocial Behavior in Children and Adolescents: Interventions, Practices. (1 cr)
Community-/school-based intervention programs aimed at preventing antisocial behavior.

Chinese (Chn)

Department of Asian Languages and Literatures

College of Liberal Arts

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

Chn 5015. Chinese Philosophical/Historical Texts. (4 cr, Prereq–3112)
Readings from major texts in Chinese philosophical and historical traditions.

Traditional Chinese religious systems through selected texts.

Chn 5040. Readings in Chinese Text. (2-4 cr [max 12 cr]; A-F only, Prereq–3032 or equiv or #)
Students read authentic materials 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 5230. Topics in 20th-Century Chinese Literature. (4 cr [max 8 cr], Prereq–3032)
Studies of representative literary works from May 4, 1919 to the present.

Chn 5240. Topics in Chinese Poetry. (4 cr [max 8 cr], Prereq–3112)
Selected major Chinese poets and poetic forms.

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, hydraulics, hydrology, construction, environmental, or transportation problems. Investigations, reports, designs.

CE 5170. Internet Based Study. (1-5 cr [max 15 cr]; A-F only, Prereq–Upper div II)
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 5211. Traffic Engineering. (3 cr, Prereq–3201, Stat 3021 or equiv)
Principles of vehicle and driver performance as they apply to the safe and efficient operation of highways. Design and use of traffic control devices. Capacity and level of service. Trip generation and traffic impact analysis. Safety and traffic studies.
CE 5212. Urban Transportation Planning. (3 cr. Prereq–3201 or equiv)
Techniques of analysis and planning for transportation services; demand-supply interactions; evaluating transportation alternatives; travel demand forecasting; integrating other systems; citizen participation in decision-making.

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 5231. Pavement Management and Rehabilitation. (3 cr. Prereq–Upper div IT or grad CE 4231 or #)

CE 5232. Advanced Portland Cement Concrete. (3 cr. Prereq–Upper div IT or Grad, CE 4322 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 4302 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. Prereq–[Grad student, 4311 or GeoE 4311 or #])
Role of microorganisms in environmental bioremediation, pollution control, water/wastewater treatment, biogeochemistry, and human health. Basic microbiological techniques: isolation, identification/ enumeration of bacteria, BOD, biodegradation kinetics, disinfection. Lecture. lab.

CE 5311. Experimental Geomechanics. (3 cr; A-F only. Prereq–[Grad student, 4311 or GeoE 4311 or #])
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 5551. Environmental Microbiology Laboratory. (4 cr; A-F only. Prereq–3501, [upper div 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–8401 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. Prereq–#)
Research or independent study in concrete, structural steel, soils, hydraulics, hydrology, and municipal, environmental, or transportational 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 8211. Theory of Traffic Flow. (4 cr)

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)
Advanced technologies specifically related to transportation. Topics drawn from core science/ technology areas of human factors, intelligent vehicles, traffic management/modeling, sensing, communications, and controls.

CE 8214. Transportation Economics. (3 cr; A-F only)

CE 8215. Stochastic Transportation Modeling. (3 cr. Prereq–8210 or 8211, Stat 5021 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 8219. 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, Burmeister model, and Westergaard model; load transfer in rigid pavements; temperature induced stresses; mechanics of drainage.

CE 8233. Advanced Bituminous Materials Characterization. (3 cr. Prereq–[3402, 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)
Presentations on various topics.

CE 8301. Fracture of Geomaterials. (3 cr; A-F only. Prereq–IT student, 5321, Geol 5321 or #)

CE 8302. Soil/Rock Plasticity and Limit Analysis. (4 cr; A-F only. Prereq–IT grad student, 4301 or #)

CE 8311. Advanced Rock Mechanics. (3 cr; A-F only. Prereq–IT grad student, 4311 or GeoE 4311 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. 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 application.


CE 8333. FTE: Master’s. (1 cr; NGA. Prereq—Master’s student, adviser and DG5 consent)


CE 8337. Boundary Element Methods II. (3 cr; A-F only. Prereq—8336, GeoE 8336 or #) Transient and nonlinear problems.

CE 8351. Advanced Groundwater Mechanics I. (3 cr; A-F only. Prereq—4351 or GeoE 4351, IT grad student or #) Solute transport; shallow flow in leaky aquifers; complex variable methods in groundwater flow. Analytic element method: 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. 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. 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 of linear continuum and structural problems. Isoparametric elements and numerical integration. Basic concepts of error analysis and convergence. Application to plates and shells. Introduction to mixed methods and time dependent problems.


CE 8412. Shell Structures. (3 cr; A-F only. Prereq—IT grad student 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—4421 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—4411 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—4413 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 8444. FTE: Doctoral. (1 cr; NGA. Prereq—Doctoral student, adviser and DG5 consent)

CE 8451. Behavior of Reinforced Concrete Structures. (3 cr; A-F only. Prereq—4451 or #) Advanced topics; experimental and theoretical background to design code 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 course) 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 8503. Environmental Mass Transport. (4 cr; A-F only. Prereq—5322 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 atmospheric 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 disinfection.

CE 8505. Biological Processes. (3 cr; A-F only. Prereq—4502, 4501 or #) Theoretical principles underlying chemical and biological wastewater treatment processes, including anaerobic and aerobic treatment processes, activated sludge, 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 3021 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 and spectral analysis; series of long-range dependence; linear estimation; geostatistics; sampling networks; hydrologic forecasting.


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

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 natural organic matter.

CE 8542. Chemistry of Organic Pollutants in Environmental Systems. (3 cr; A-F only. Prereq—[4541, 5541] or #) Structural characteristics and physico-chemical properties of organic contaminants in 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; A-F only. Prereq—5551 or #) Introduction to microbial genetics and molecular phylogeny. Application of nucleic-acid techniques in environmental microbiology and microbial ecology.

CE 8552. Groundwater Microbiology: Laboratory. (4 cr; A-F only. Prereq—Grad CE major or #, exposure to basic enviorn engr and microbiol) Subsurface microbial ecology, biogeochemical cycling, metal classification of subsurface bacteria, modeling bacterial transport, diagnosis of microbial induced fouling (MIF) events, bioremediation of contaminated aquifers. Lectures and four lab hours per week.

CE 8553. Biofilms. (3 cr; A-F only. Prereq—4551 or #) Science/engineering concepts to investigate formation/function of biofilms. Properties/composition of biofilms, transport/transformation processes in biofilms, communication in biofilms, mathematical modeling. Applications in environmental engineering.


CE 8562. Analysis and Modeling of Aquatic Environments II. (3 cr [max 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; A-F only. Prereq—3502 and 4501 or #) Introduction to industrial waste treatment. Individual industries, emphasizing constituents of the waste stream and how best to recover, recycle or reduce wastes. Cost concerns and regulations. Field trips to various industries to gain first-hand knowledge of processes involved in treatment.

CE 8571. Hydraulic Measurements. (3 cr; A-F only. Prereq—3502 or #) Lab and field methods and instruments for measuring hydraulic pressure, velocity, and discharge.

CE 8572. Computational Environmental Fluid Dynamics. (4 cr; A-F only. Prereq—Grad student in IT or COAES 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 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)

CE 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])

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

Classical Civilization (CIV)

Department of Classical and Near Eastern Studies
College of Liberal Arts


Classics (ClC)

Department of Classical and Near Eastern Studies
College of Liberal Arts

ClC 5001. Classical Lyric and Satire. (3 cr. Prereq—3001, two literature courses or #) Greek and Roman lyric poetry; Roman satire.

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


ClC 5070. Topics in Ancient Religion. (3 cr. Prereq—RelA 3071 or 3072 or 3073 or 5071 or 5072 or 5073 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. Focus on emerging centers of Hellenistic culture in Mediterranean and in Etruscan and Roman towns from 400 B.C. to the beginnings of the Roman Empire.

ClC 5080. New Testament Proseminar. (3 cr. Prereq—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.


ClC 5083. Ancient Comedy. (3 cr. §3083) Greek/Roman comic drama (e.g., Aristophanes, Menander, Plautus, Terence).

ClC 5085. Greek Philosophy: The Pre-Socratics to Plato. (3 cr) Fragments of the pre-Socratics and Sophists and selected dialogues of Plato.


ClC 5103. Hellenistic and Early Roman Art and Archaeology. (3 cr. Prereq—Jr, Clas/Arth 3088 or #) Sculpture, architecture, painting, and topography in developing centers of Hellenistic culture in Mediterranean and in Etruscan and Roman towns from 400 B.C. to the beginnings of the Roman Empire.

ClC 5108. Greek Architecture. (3 cr. Prereq—Jr, Clas/Arth 3088 or #) Survey of Greek architecture; Greek and Roman temples, colonnades, public buildings, and domestic architecture.

ClC 5110. Prehistoric Art and Archaeology of Greece. (3 cr. Prereq—Jr, Clas/Arth 3088 or #) Survey of Greek art and archaeology from prehistoric period of Greece to Roman period. Artistic and cultural forms of Neolithic period in Aegean area and Cycladic, Minoan, and Mycenaean cultures. Aims and methods of modern field archaeology; the record of human habitat in the Aegean area. Archaeological evidence as a basis for historical reconstruction.

ClC 5112. Archaic and Classical Greek Art. (3 cr. Prereq—Jr, Clas/Arth 5111) Survey of Greek art and architecture; Greek cultures of Mycenaean and Archaic periods.

For definitions of course numbers, abbreviations, and symbols, see page 153.
Courses

Class 5120. Field Research in Archaeology. (3 cr; Prereq—)
Field excavation, survey, and research at archaeological sites in the Mediterranean area. Techniques of excavation and exploration; interpretation of archaeological materials.

Class 5145. Advanced Greek and Roman Mythology. (3 cr; Prereq—1062 or #)
Different theoretical approaches to Greek/Roman mythology.

Class 5172. House, Villa, Tomb: Roman Art in the Private Sphere. (3 cr; Prereq—Intro art history 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 the physical evidence in illuminating gender roles.

Class 5182. Art and the State: Public Art in the Roman Empire. (3 cr; Prereq—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.

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

Class 5252. History of Early Christian Art in Context. (3-4 cr related to lab) 3940 credit course or #)
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.

Class 5340. Practicum in Archaeological Field and Computer Techniques. (3 cr. §3340. Prereq—CCV 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 selected site in Minnesota for day-long sessions for 9 to 10 weeks. Meets with 3340.

Class 5794. Introduction to Classical and Near Eastern Studies. (1 cr; S-N only. Prereq—Grad major or minor or #)
Introduction to core research materials and reference materials in the various disciplines which make up classical studies.

Class 5940. Topics in Classical Literature. (3 cr; max 9 cr; §3940. Prereq—Two literature courses or #)
Additional work for graduate credit. Topics specified in Class Schedule. Meets with 3940.

Class 5950. Aspects of Classical Culture. (1-3 cr; §3950)
Topics specified in Class Schedule. Meets with 3950.

Class 5993. Directed Studies. (1-4 cr; max 12 cr; Prereq—A, D)
Guided individual reading or study.

Class 5994. Directed Research. (1-12 cr; Prereq—A, D, #)
Selected issues, with special attention to current scholarly disputes. Topics specified in Class Schedule.

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

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

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

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

Class 8888. Thesis Credits: Doctoral. (1-24 cr; max 100 cr; NGA, Prereq—Max 18 cr per semester or summer; 24 cr required)

Class 8950. Topics in Classical Studies. (3 cr; max 12 cr)
Topics such as slavery, women in antiquity, pagans and Jews, the taboo, and modern study of myth.

Clinical Laboratory Science (CLS)

Department of Laboratory Medicine and Pathology

Medical School

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

CLS 5065. Introduction to Classical Immunohematology: Laboratory. (2 cr; A-F only. 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; A-F only. 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. Prereq—Microbiology course with lab, biochem course)
Lab diagnosis of viral, fungal, and parasitic infections. Lecture.

CLS 5104. Principles of Diagnostic Microbiology: Lecture. (2 cr; A-F only. Prereq—One microbiology course with lab, one biochemistry course, #)
Current techniques used in lab diagnosis of infectious disease. Isolating/identifying bacteria and yeasts. Antimicrobial susceptibility testing. Lecture.

CLS 5105. Principles of Diagnostic Microbiology: Laboratory. (2 cr; A-F only. 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; A-F only. Prereq—)
Supervised teaching experience, develop skills using instructional materials, tests, and measurements.

CLS 5127. Introduction to Management and Education. (1.1 cr; A-F only. Prereq—)
Leadership styles, employee selection and evaluation, communications, motivation, morale, discipline, job descriptions, record keeping, budgets, cost accounting, purchasing, product evaluation, lab safety, labor relations, government regulations.

CLS 5130. Practicum in Laboratory Administration. (2 cr; A-F only. 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; 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; Prereq—)
Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5165. Advanced Clinical Immunohematology. (3 cr; Prereq—)
Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5175. Advanced Clinical Chemistry. (3 cr; Prereq—)
Observation, study, and practice in special problems, advanced techniques, and methodology.

CLS 5251. Hematology I: Basic Techniques. (3 cr; A-F only. 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. Prereq—5251 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. Prereq—5251 or MedT 4251)
Theory and application of specific concepts and techniques in hemostasis and coagulation. Lecture and lab.

CLS 5310. Clinical Chemistry I: Lecture. (2 cr; A-F only. Prereq—Organic chem course with lab, biochem course, #)
Principles and theory of clinical chemistry for assessing renal and metabolic disease/dysfunction, electrolyte balance, and acid-base balance. Principles and processes for quality management in the clinical lab.

CLS 5311. Clinical Chemistry I: Laboratory Applications. (2 cr; A-F only. 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. Prereq—Organic chem course with lab, biochem course, 5310 or MedT 4310, #)
Principles and theory of clinical chemistry for assessing metabolic disease/dysfunction involving 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. Prereq—Organic chem course with lab, biochem course, 5310 or MedT 4310, #)
Application of clinical chemistry principles and lab techniques in analyzing serum, plasma, and urine. Focus on tests to evaluate specific disorders. Developing lab and instrumentation use skills with emphasis on quality control and technique.

CLS 5768. Advanced Hematology. (5-10 cr max 30 cr. Prereq—)
Clinical 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. 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 decisions and problems used as practice vehicles.

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

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

Cognitive Science (CgSc)

College of Liberal Arts

CgSc 8000. Philosophy of Cognitive Science. (3 cr. 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. (1-13 cr [max 6 cr]; Prereq—Grad cog sci minor or #) Lectures and in-depth discussion on a topic.

Communication Disorders (CDis)

Department of Communication Disorders

College of Liberal Arts


CDis 5401. Counseling and Professional Issues. (2 cr. Prereq—4501 or 4601 or 4801 or #) Basic counseling principles and current professional issues in communication disorders. Application of counseling theory to clinical practice. Analysis of regulation, practice, and future direction of communication disorders.

CDis 5501. Fluency Disorders. (3 cr. Prereq—4501 or #) Description, nature, and treatment of fluency disorders in children and adults. Involvement in therapeutic and research activities.


CDis 5503. Motor Speech Disorders. (3 cr. Prereq—3305, 4301, 4501) or #) Dysarthria, speech-production disorders resulting from neurologic disorders or lesions, and apraxia of speech, a disorder of the volitional control of speech. Nature and management of motor speech disorders in adults and children.

CDis 5504. Dysphagia. (3 cr. Prereq—3305, 4301, 4501, 4601 or #) Normal and disordered aspects of swallowing. The nature, etiologies, evaluation, and management of swallowing disorders will be covered.

CDis 5602. Fluency and Phonological Disorders. (3 cr. Prereq—3304, 4601 or #) Theory/research related to nature, assessment, and treatment of phonological disorders in children.

CDis 5603. Language and Cognitive Disorders in Children. (3 cr. Prereq—3303, grad student) or #) Language assessment, teaching procedures used with children/adults. Procedures apply to children who face language disabilities such as developmental delays, autism, learning disabilities.

CDis 5604. Language Assessment and Intervention: School Age Children. (3 cr. Prereq—4601 or #) Strategies, models and service-delivery options in assessment and intervention for school-age children with language impairments. Emphasis on practical applications for speech-language pathologists.

CDis 5605. Language and Cognitive Disorders in Adults. (3 cr. Prereq—3302, 4301, 4601 or #) Neuropsychiatric and cognitive disorders in adults, including aphasia, right-hemisphere syndrome, traumatic brain injury, and dementia. Consideration of neurologic substrates, assessment and diagnosis, and clinical intervention.

CDis 5606. Introduction to Augmentative and Alternative Communication. (3 cr. Prereq—4501, 4601 or #) Description of the range of augmentative and alternative communication applications for persons with developmental and acquired disabilities.

CDis 5607. Electronic Communication Aids. (3 cr. Prereq—5606 or #) Operational procedures for dedicated augmentative communication aids and related software applications. Design and implementation assessment and intervention strategies relevant to dynamic and fixed display devices. Troubleshoot common technical difficulties encountered by individuals using electronic communication aids.

CDis 5801. Audiologic Assessment I. (3 cr. Prereq—4801 or #) Basic audiometric battery including pure tones, speech, masking, and inimmittance in adults; industrial audiology and ototoxic emissions.

CDis 5802. Hearing Aids I. (3 cr. Prereq—3305, 4801 or #) Survey of modern hearing aids including history of development, electroacoustic functions, clinical and laboratory measurement techniques, sound field acoustics, techniques for selection.

CDis 5803. Hearing Loss in Children: Diagnosis. (3 cr. Prereq—4801 or #) Behavioral, physiological approaches to assessment and identification, development of the auditory mechanism, etiologies of hearing losses in infants, children, selection of sensory aids, principles of case management with children and families.

CDis 5810. Laboratory Module in Audiology. (1-2 cr [max 5 cr]. Prereq—4801 or #) Intensive study of clinical methods in audiology. Supplements didactic courses in audiology curriculum. Laboratory study, individually or in small groups.

CDis 5900. Topics: Communication Disorders. (1-3 cr) Topics listed in communication disorders office.

CDis 5993. Directed Study. (1-12 cr [max 18 cr]. Prereq—#) Directed readings and preparation of reports on selected topics.

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

CDis 8410. Seminar: Research. (3 cr [max 12 cr]) Advanced study exploring application of experimental and quasi-experimental research designs used in single-subject and group research.
Courses

Communication Studies (Comm)

Department of Communication Studies
College of Liberal Arts

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


Comm 5220. Television Genres. (3 cr [max 3 cr]) Nature, historical development, and influence on society of specific genres of television programming: drama, situation comedy, mystery, soap opera. Program genre change over time and how society, government regulation, and economics of production influence that historical process.

Comm 5233W. 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, hygienic standards, literacy, and awareness of civic responsibility.

Comm 5261. Political Economy of Media Culture. (3 cr. Prereq–3211 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–3401 or grade) Survey of major theoretical approaches to communication including: positivism, constructivism, and systems.

Comm 5402. Advanced Interpersonal Communication. (3 cr. Prereq–1102, 3402 or 3411 or 3431 or 3441 or 3451.) Social scientific approaches to interpersonal communication; theory and research findings.


Comm 5406. Communication and Gender. (3 cr. Prereq–One women's studies course or #) 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–3411 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–3401 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–3431) 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 5451W. 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 5462. Field Research in Spoken Language. (3 cr. Prereq–5461, Ling 3001 or Ling 5001) Transcribing and analyzing verbal communication and movement related to it. Applying concepts to recorded conversations.


Comm 5617. History and Criticism of U.S. Public Discourse: 1630-1865. (3 cr. Prereq–37) 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–37) 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 300-, 400, 500 Comm or 300+ cr, #, L, D) 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 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 8211. Critical Communication Studies: History, Theory, Method. (3 cr) Qualitative research methods for studying media institutions, texts, audiences, and contexts.


Comm 8333. FTE: Master’s. (1 cr; NGA; 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; NGA; 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 #) Rhetorical criticism theories and methods. Rhetoric as applied to literary studies and the growth of hermeneutics as vantage points for reassessing rhetorical methods.

Comm 8606. Seminar: Rhetorical Analysis of Campaigns and Movements. (3 cr. Prereq–5431, 5617 or 5618, 10 or 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 60 cr]; NGA, Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

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

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

Comm 8994. Directed Research. (1-3 cr [max 6 cr]; S-N only) Supervised research project.
Comparative Literature (CLit)

Department of Cultural Studies and Comparative Literature

College of Liberal Arts

CLIT 5331. Discourse of the Novel. (3 cr §CSCL 5331) Comparative study of the novel (eighteenth century to present): its relation to ordinary language practices, emergent reading publics, technologies of cultural dissemination, problems of subjectivity; its role in articulating international cultural relations.

CLIT 5555. Introduction to Semiotics. (3 cr. §CSCL 5555) Problems of the nature of the sign; sign function; sign production; signifying systems as articulated in philosophy, linguistics, anthropology, psychoanalysis, and art theory. Applying semiotics to various signifying practices (e.g., literature, cinema, daily life).

CLIT 5751. Basic Concepts of Cinema. (4 cr. §CSCL 5751. §CSDS 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.

CLIT 5910. Topics in Comparative Literature. (3 cr [max 24 cr]) Topics specified in Class Schedule.

CLIT 5992. Directed Reading in Comparative Literature. (1-3 cr [max 9 cr]. Prereq–#) Guided individual reading and study.

CLIT 8001. Basic Seminar in Comparative Literature I. (4 cr) Key texts, positions, and problematics in field of comparative critical theory. Special attention to historical precursors, influential contemporary debates, and disciplinary genealogies.

CLIT 8002. Basic Seminar in Comparative Literature II. (4 cr) Key texts, positions, and problematics in field of comparative critical theory. Special attention to historical precursors, influential contemporary debates, and disciplinary genealogies.

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

CLIT 8362. Modernity and Its Others. (4 cr) Dialectical interrogation of Western and non-Western theories of modernity. Reckoning with differences and variations in its history, providing an account of the normative category of modernity (designated as European), and alternative articulations around the globe.

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

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

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

CLIT 8901. Pedagogy of Cultural Studies and Comparative Literature. (3 cr. Prereq–Grad Comp Lit major) Prepares 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–#)

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. §CSCL 5301) Recent critical theories of relation of arts to social/ideological forces. Selected artifacts 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. §CSCL 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. §CSCL 5751. §CSDS 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 5910. 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 5993. Directed Study. (1-3 cr [max 9 cr]. Prereq–#) Guided individual reading and study.

CSDS 8001. Basic Seminar in Comparative Studies in Discourse and Society I. (4 cr) Key texts, positions, and problematics 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 problematics in field of comparative critical theory. Special attention to historical precursors, influential contemporary debates, and disciplinary genealogies.

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

CSDS 8366. Doctoral Pre-Thesis Credits. (1-18 cr [max 60 cr]; NGA. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

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

CSDS 8901. Pedagogy of Cultural Studies and Comparative Literature. (3 cr. 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 8910. 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 8920. 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 8993. Directed Study in Comparative Studies in Discourse and Society. (1-4 cr [max 12 cr]. Prereq–#)

CSDS 8994. Directed Research in Comparative Studies in Discourse and Society. (1-4 cr. Prereq–#)

Computer Engineering (CmpE)

Department of Electrical and Computer Engineering

Institute of Technology

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

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

Computer Science (Csci)

Department of Computer Science Institute of Technology

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 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 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
CSci 5115. User Interface Design, Implementation and Evaluation. (3 cr. Prereq-4041 or #) Theory, design, programming, and evaluation of interactive graphical user 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. §4131. Prereq-5106 or 5211 or #) 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, internet.

CSci 5161. Introduction to Compilers. (3 cr. Prereq-4041 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 mechanisms.


CSci 5211. Data Communications and Computer Networks. (3 cr. §4211. Prereq–4041 or #) Fundamentals of network design; principles and protocols of computer networks. Layered network architectures, data link protocols, local area networks, network layer/routing protocols, transport, congestion control, multiplexing, high-speed networks, networking interfaces, networked applications. Case studies using Ethernet, Token Ring, FDDI, TCP/IP, ATM, Email, HTTP, and WWW.


CSci 5403. Computational Complexity. (3 cr. Prereq–4041 or #) Computational models, complexity measures in each model, and related complexity classes.


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 parallelism, parallel programming paradigms, message passing programming in MPI, data parallel programming in HPF, shared-address space programming in threads.


CSci 5519. Artificial Intelligence II (non-W). (3 cr. §5512. Prereq–5511 or #) See §5512W for description.


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 5801. Software Engineering I. (3 cr. §4081W. Prereq–1902, 2011) 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 maturity 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–#) 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 §5-N only §Prereq–[CSci or Comp] 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. Operating Systems Theory. (3 cr. Prereq–8101 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 unprocessors and parallel computers. Fundamental program analysis instruments such as data flow analysis and data dependence analysis. Variety of code generation and transformation techniques.


CSci 8211. Advanced Computer Networks and Their Applications. (3 cr. Prereq–5211 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.

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. NGA. 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 8444. FTE: Doctoral. (1 cr; NGA. 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 design of agents with a physical body; dealing with sensors and actuators; world modeling.

CSci 8666. Doctoral Pre-Thesis Credits. (1-18 cr; NGA. 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 8705. Scientific Databases and Applications. (3 cr. Prereq–5708 or #) Application domains of geographical information systems, common data types, queries and analyses, data models, languages to query, query optimization, access methods, clustering methods and file structures, system architectures and design (e.g., parallelism, extensibility), and new trends (e.g., spatial graphs).

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; NGA. Prereq–Max 18 cr per semester or summer; doctoral student who has not passed prelim oral)

CSci 8888. Thesis Credits: Doctoral. (1-24 cr; Max 100 cr; NGA. Prereq–Max 18 cr per semester or summer; 24 cr required)

CSci 8991. Independent Study. (1-3 cr. Prereq–#)

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

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

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

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

CBio 8888. Thesis Credits: Doctoral. (1-24 cr; Max 100 cr; NGA. Prereq–Max 18 cr per semester or summer; 24 cr required)

Control Science and Dynamical Systems (CSDy)

Institute of Technology

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

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

CSDy 8888. Thesis Credits: Doctoral. (1-24 cr; Max 100 cr; NGA. 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 TF 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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCL 5147</td>
<td>Teaching as Dialogue</td>
<td>(3 cr)</td>
<td>Teaching and the teacher are the subject. Entering into dialogue is the method. Issues with the politics of teaching, the meaning of entering into dialogue, questions of judgment, and the idea of self-teaching as the goal of teaching.</td>
</tr>
<tr>
<td>CSCL 5154W</td>
<td>Theoretical Constructions of Space</td>
<td>(3 cr)</td>
<td>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 for representations for personal identity.</td>
</tr>
<tr>
<td>CSCL 5256</td>
<td>Suburbia</td>
<td>(3 cr)</td>
<td>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.</td>
</tr>
<tr>
<td>CSCL 5301</td>
<td>Society, Ideology, and the Production of Art</td>
<td>(3 cr)</td>
<td>Recent critical theories on the relation of the arts to social and ideological forces; selected artifacts from Western culture (Renaissance to 20th century; high, popular, and mass culture). Music, visual art, literature.</td>
</tr>
<tr>
<td>CSCL 5302</td>
<td>Aesthetics and the Valuation of Art</td>
<td>(3 cr)</td>
<td>Society, ideology, and aesthetic value considered in light of recent critical theories of visual art, music, and literature. Meditations of place, social class, gender and ideology on aesthetic judgment in post-Renaissance Western culture.</td>
</tr>
<tr>
<td>CSCL 5331</td>
<td>The Discourse of the Novel</td>
<td>(3 cr)</td>
<td>Comparative study of the novel, 18th century to present. Its relations to ordinary language practices, emergent reading publics, technologies of cultural dissemination, problems of subjectivity, and its role in articulating international cultural relations.</td>
</tr>
<tr>
<td>CSCL 5555</td>
<td>Introduction to Semiotics</td>
<td>(3 cr)</td>
<td>Problems of the nature of the sign; sign function; sign production; signifying systems as articulated in philosophy, linguistics, anthropology, psychoanalysis, and art theory. Application of semiotics to various signifying practices (literature, cinema, daily life).</td>
</tr>
<tr>
<td>CSCL 5711</td>
<td>Sociocriticism</td>
<td>(3 cr)</td>
<td>Sustained consideration of the modern tradition of sociological reflection on literature. Early and late Birmingham School, Frankfurt School, Bakhtin circle, and the various French initiatives associated with both Les Temps Modernes and Tel Quel.</td>
</tr>
<tr>
<td>CSCL 5751</td>
<td>Basic Concepts of Cinema</td>
<td>(4 cr)</td>
<td>Examination of the cinema as an object of theoretical and historical analysis. Emphasis on the concepts that have emerged to radically transform the scope and aim of film analysis since the 1960s. Readings of films and theoretical texts.</td>
</tr>
<tr>
<td>CSCL 5835</td>
<td>Richard Wagner’s “Der Ring des Nibelungen”: Music, Myth, and Politics</td>
<td>(3 cr; Prereq–#)</td>
<td>Literary and musical analysis and historical context of the four works of Wagner’s “Ring”. Das Rheingold, Die Walküre, Siegfried, Götterdämmerung. Critical assessment of Wagner’s achievement and influence.</td>
</tr>
<tr>
<td>CSCL 5910</td>
<td>Topics in Cultural Studies and Comparative Literature</td>
<td>(3 cr [max 24 cr])</td>
<td>Topics specified in Class Schedule.</td>
</tr>
</tbody>
</table>

### Directed Study (3 cr; max 9 cr; Prereq–#)

- CSCL 5993: Guided individual reading or study.

### Curriculum and Instruction (CI)

**Department of Curriculum and Instruction**

**College of Education and Human Development**

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Credits</th>
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</tr>
</thead>
<tbody>
<tr>
<td>CI 5008</td>
<td>Theory and Practice of Teaching Art in Elementary Schools</td>
<td>(1-2 cr; A-F only)</td>
<td>Art concepts, skills, processes appropriate for elementary school. Methods of art instruction. Art programs and instruction in the classroom. Children's production of responses to art.</td>
</tr>
<tr>
<td>CI 5045</td>
<td>Advanced Contemporary Crafts</td>
<td>(2 cr; A-F only)</td>
<td>In-depth experiences in craft techniques, including ceramics, fibers, jewelry, and metal design, with emphasis on design analysis, understanding of materials, and mastery of processes.</td>
</tr>
<tr>
<td>CI 5049</td>
<td>Art Media Techniques</td>
<td>(1-4 cr; A-F only)</td>
<td>Lectures, demonstrations, studio labs and critique session on creative processes; handling specific media. Topic varies.</td>
</tr>
<tr>
<td>CI 5050</td>
<td>Issues in Art Education</td>
<td>(1-4 cr (max 12 cr))</td>
<td>Issues/trends, current practices, recent research.</td>
</tr>
<tr>
<td>CI 5052</td>
<td>Introduction to Art Therapy</td>
<td>(2 cr; A-F only)</td>
<td>History, current conceptions, and practices of art therapy.</td>
</tr>
<tr>
<td>CI 5055</td>
<td>Postmodern Visual Culture and Global Education</td>
<td>(1-3 cr; A-F only, Prereq–Grad student)</td>
<td>Representations of knowledge. Postmodern conditions of education and relationships to the influences of visual culture. Introduction to issues concerning the value and importance of visual imagery; influence of computer networking, mass communication, and other image sources.</td>
</tr>
<tr>
<td>CI 5065</td>
<td>Improving Art Programs in the Schools</td>
<td>(3 cr; A-F only, Prereq–Initial lic students majoring in art ed)</td>
<td>Issues of art instruction, including teaching methods and evaluation, philosophical frameworks of pedagogy, and institutional issues concerning art programs in primary and secondary schools. Socio-cultural structures of schooling; practical issues of teaching art.</td>
</tr>
<tr>
<td>CI 5069</td>
<td>Curriculum Innovations in Art Education</td>
<td>(3 cr; A-F only)</td>
<td>Study and analysis of innovations; evaluation of materials for teaching units and projects.</td>
</tr>
<tr>
<td>CI 5075</td>
<td>The Social and Historical Foundations of Art Education</td>
<td>(1-3 cr; A-F only, Prereq–Grad student)</td>
<td>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 general culture. Seminar discussions include problems of cross-cultural and multicultural art education.</td>
</tr>
<tr>
<td>CI 5078</td>
<td>Application of Aesthetic Theory in Education</td>
<td>(2 cr; A-F only)</td>
<td>Contemporary theories of art; psychological and philosophical foundations. Open to teachers, supervisors, and administrators concerned with art in general education at all levels.</td>
</tr>
<tr>
<td>CI 5096</td>
<td>Art Education: Practicum</td>
<td>(1-6 cr (max 6 cr); A-F only)</td>
<td>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.</td>
</tr>
<tr>
<td>CI 5097</td>
<td>Student Teaching in Art Education</td>
<td>(8 cr; S-N only, Prereq–licensure student in art ed)</td>
<td>Observation of, participation in, and supervisory experiences with various types and levels of art classes.</td>
</tr>
</tbody>
</table>

### Comparing the Discourse of the Novel | (3 cr | A-F only; Prereq–Foundations of ed major or elem ed initial lic) | Curriculum organization, instruction, management, assessment, professional decision making. |

### 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. |

### Curriculum Planning and Design | (3 cr; A-F only, Prereq–Grad student) | Application of the theoretical and practical bases of disciplinary and interdisciplinary curriculum design to the problems of designing, implementing, and evaluating the quality of a course or program of study. |

### History of the American Curriculum | (3 cr) | Survey of formation of public school subjects and curriculum theory in United States. Social, political, and economic implications of curriculum theory. |

### Multicultural Gender-Fair Curriculum | (3 cr; A-F only, Prereq–Grad student) | 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 curriculum change; language, culture, sexual preference, special needs students, and the conflicts between culture and curriculum. |

### 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. |

### Multicultural and Moral Perspectives on Classroom Instruction | (3 cr; Prereq–Social or moral development course) | Review of history, traditions, and efficacy of moral education programs in the schools; current school and district programs. Includes site visits to schools that are implementing social skills programs. |

### Reflective Teaching and Professional Ethics | (3-4 cr; Prereq–Teaching license and one yr teaching exper) | 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. |

### Language, Culture, and Education | (3 cr; A-F only, Prereq–MEd or grad student) | Applies current sociocultural and discursive theories to research and development of language programs. Includes site visits to schools that are implementing social skills programs. |

### Curriculum, Instruction, and Assessment | (3 cr; A-F only, Prereq–Grad student) | Current research/issues that cross disciplinary boundaries in curriculum development, instructional practices, and assessment methods. Interrelations among curriculum, instruction, and assessment within framework of constructive learning theory. Individual classroom practices/theories. |
CI 5162. Peer Coaching for Teachers. (1-2 cr; A-F only.
Prereq—Teaching experience) 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 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, further investigating the topic, and writing a report on the project.

CI 5178. Project in Teacher Leadership. (3-6 cr. 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.

CI 5181. Clinical Experience in Elementary School Teaching. (4-8 cr; S-N only. Prereq—Foundations of Education and Elem Ed; consult with advisor) 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 initial licensure only) Supervised experience in elementary classrooms.

CI 5186. School-Related Projects. (1-4 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 adviser.

CI 5187. Practicum: Improvement of Teaching in Elementary or Prekindergarten Schools. (2-3 cr; S-N only. Prereq—Foundations of Ed in Elem or Early childhood) Elementary school classroom teaching project designed to improve specific teaching skills. Approved and directed by adviser.

CI 5190. Directed Individual Study in Curriculum and Instruction. (1-6 cr; max 12 cr. 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; A-F only. Prereq—JMed student in ECE or ECSE) or #) Surveys imagery, history, philosophy, and psychology of early childhood education. Analyzing/interpreting trends in early education, including diversity, special needs, legislation, public policy, and educationally appropriate practice.

CI 5252. Facilitating Social and Physical Learning in Early Childhood Education. (3 cr. Prereq—MEd student in early childhood ed or in 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 Early Childhood Education. (3 cr; A-F only. Prereq—MEd student in early childhood ed or early childhood special ed) 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—Pre-K Education/Education/Elementary Education or M.Ed./LP Education 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; S-N only. Prereq—MEd student in early childhood ed or early childhood special ed) Application of theory/research related to teaching preschool children. For individuals obtaining ECE license.

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) 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) Design/Planning for technology integration in K-12 contexts. Foci on school, district, state, and national levels. School visits, guest speakers, school-focused technology planning project.

CI 5342. School Technology Planning. (1 cr; A-F only) How to establish plans for use of technology that support K-12 instruction and student learning. Facilitating ongoing comprehensive planning for technology integration. Identifying priorities for technology planning.

CI 5343. School Technology Funding. (1 cr; A-F only) Prereq—[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) Developing a multi-year funding strategy for establishing K-12 technology integration in accordance with a technology vision/plan.

CI 5344. Facilitating Technology Integration in Classrooms I. (1 cr; A-F only) Intersection of student learning theories and research base on effective technology practices. Video cases of technology-supported teaching, peer teaching exercise.

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) Technology-supported teaching/learning at one’s educational site. Preparing a vision statement for technology’s role in student learning. How to assume an advocacy role in establishing technology use for instruction/learning.

CI 5346. Staff Technology Development and Support. (1 cr. Prereq—[Mac or PC] with at least 256 MB of RAM, [Windows NT or 2000 or XP or Mac OS 9 or 10], Pentium 2 or faster, Internet connection, up-to-date version of [Netscape, Internet Explorer], virus protection software, #) How to lead organization in designating, implementing, evaluating, improving, and sharing approaches to staff development and technology-related staff development. Facilitating development through use of technology.

CI 5351. Technology Tools for Educators. (3 cr; A-F only. Prereq—Basic knowledge of Macintosh operating system and a word processing program) Develop skills in using selected technology applications to support teaching and learning. Internet applications, presentation software, computer authoring tools, desktop publishing software, Web page creation. May also include a field-site project.

CI 5361. Teaching Via the Internet. (3 cr) Examination of the capabilities of the Internet for professional development and instructional use. Use of specific client/server software and multimedia authoring tools, desktop publishing software, Web page creation. May also include a field-site project.


CI 5363. Introduction to Computer-Based Instructional Design. (3 cr; A-F only) Learn to design and develop computer-based instructional materials using a state of the art authoring language. Introduction to principles of courseware design; multimedia components in instruction; development of computer courseware using the authoring language and tutorial design.

CI 5364. Computer-Based Instruction: Games and Simulation. (3 cr; A-F only. Prereq—5363) Principles and procedures of computer simulation and game design. Type of computer simulation, the components common to simulation design, and the theory underlying educational simulation design.

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, 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 online.

CI 5401. Literature for the 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; selection of literature for themed instruction.

CI 5402. Introduction to Special Collections. (2-4 cr; A-F only. Prereq—Children’s lit course) Special collections of children’s literature as research material. Study of manuscripts, original art, and letters. Materials from the Kerlan Collection in Walter Library will be available.

CI 5403. Creative Writing For and By Children. (2-4 cr; S-N only. Prereq—Children’s lit course) Creative aspects of writing and illustrating children’s literature and children’s writing. Features authors and illustrators of children’s books.

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–Elem teaching exper or #) Integration of skill and aesthetic activities in graded and non-graded primary and intermediate settings. Use of national and state language arts standards and statewide assessment protocols to examine elementary literacy curricula.

CI 5416. Literacy Development in the Intermediate Grades. (3 cr; A-F only. Prereq–Elem teaching exper or #) Theory and practice of integrated teaching of literacy, reading, writing, and language.

CI 5417. Whole Language Teaching and Learning in the Elementary School. (3 cr; A-F only. Prereq–MED or grad student, minimum one yr teaching exper) Theory, research, and politics of whole language teaching. Applications for developing an elementary school whole language curriculum.

CI 5422. Teaching Writing in the Elementary School. (3 cr; A-F only. Prereq–Init lic or MED or grad student) Theory of and research on the writing process. Applications to developing an elementary school writing curriculum.

CI 5424. Reading, Language Arts, and Literature: Primary. (3 cr; A-F only. Prereq–ELM ed init lic only) Curricular and methodological issues of reading, language arts, and children’s literature. Major topics include emergent literacy, reading process, strategy instruction for word recognition and comprehension, methods of word recognition, authentic assessment strategies, and teaching diverse students.

CI 5431. Introduction to Instructional Leadership in K-12 Reading. (3 cr; A-F only. Prereq–5431 or 5451) Research-based reading instruction for elementary grades. How to help other teachers improve practice. Characteristics of effective schools within context of improving students’ reading achievement.

CI 5433. Instructional Leadership in Reading for the Middle and Secondary Grades. (3 cr; A-F only. Prereq–5432) Curriculum/instruction for middle/secondary school students.


CI 5435. Professional Development and Evolving Practice in K-12 Reading. (1 cr [max 3 cr]; A-F only. Prereq–5432 or 5433 or 5434) Development of professional competence in standards for teaching K-12 reading. Evolving teaching practices. Applications of current technologies.

CI 5441. Teaching Literature in the Secondary School. (2-3 cr; A-F only. Prereq–Fall, English init lic only, 2 cr; other sections, 3 cr) Current theories of teaching literature; critical approaches to analyzing literature; theory and research on response to literature; development of literature; teaching 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 reading; multicultural literature; developing teaching activities.

CI 5451. Teaching Reading in Content Areas. (3 cr; A-F only. Prereq–Fall, English init lic only) 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 init lic 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 of and explaining difficulties in writing; strategies for giving descriptive feedback to informal 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 5482. Reading, Language Arts, and Literature: Intermediate. (3 cr; A-F only. Prereq–ELM ed init licensure only) Aids the preservice teacher in understanding theory and practice in the teaching of reading to students in the upper elementary grades.

CI 5496. Directed Experiences in Teaching English. (8 cr; S-N only. Prereq–MED/init lic/30 students in English ed only) Student teaching/practicum in English post-baccalaureate students only.

CI 5500. Special Topics: Outdoor Science Education. (1-8 cr [max 12 cr]. Prereq–1200 tcgh exper) 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–MED ed init 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–Elem tcgh exper or #) 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–Init lic student 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–MED/init lic, grad student or #) Using curriculum standards to design science courses.

CI 5534. Studies in Science Education. (3 cr; A-F only. Prereq–MED/init lic, grad student or #) Improvement of science teaching through the application of research findings.

CI 5535. Foundations of Science Education. (3 cr; A-F only. Prereq–MED, 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 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., geology, health, physical sciences) 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–Init lic 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–SLC init lic only) Developing skills for selecting, organizing, providing, and assessing effective second language learning opportunities through study, practice, and reflection.

CI 5632. Communication and Comprehension in Second Language Classrooms. (3 cr; A-F only. Prereq–SLC init lic only) Comprehension and communication processes in a second language focus on listening, speaking, reading and writing; techniques for 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.
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CI 5634. Content-Based Instruction in Second Language Settings. (3 cr; A-F only. Prereq–SLC init lic only)
Content-based language instruction: principles, models and methods; learning strategy instruction; developing content-based language curriculum; and 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–Init lic 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)
Exploring policies, procedures, and instruments in use in assessing the English language proficiency and academic readiness of limited English proficient students in American public schools; academic 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 #)
English syntax from pedagogical perspective. Grammatical structures that challenge ESL learners. Analyzing meaning and errors/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. Ratios for implementing cultural awareness, culture learning, and the integration of language and culture instruction as integral to effective second language development.

CI 5656. Reading and Writing in a Second Language. (3 cr; A-F only)
Reading comprehension and composing processes in a second language; relationship between first and second language comprehension and composing processes; relationship between reading and writing; relationship of culture to reading comprehension and writing; politics of literacy; assessment of second language reading comprehension and writing proficiency; using technology to enhance literacy instruction.

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. (1-3 cr [max 12 cr])
Topics related specifically to the needs of the in-service teacher. Topics, location, credits, and duration are flexible.

CI 5662. 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; models for 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–#)

CI 5672. Language-Focused Instructional Practices and Strategies. (3 cr. Prereq–#)
Keeping a language development focus while teaching content in second language. Materials development, protractive instructional techniques, choice of form. Linguistic complexity and developmental stage of student.

CI 5693. Directed Study in Second Languages and Cultures. (1-4 cr. Prereq–#)
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 for teachers already licensed in another field. Requires students to work in a public school setting.

CI 5699. Clinical Experiences in Second Languages. (6-8 cr; A-F only. Prereq–SLC init lic 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 eqv; elem ed init lic only) Content and organization of elementary social studies programs; programs of understanding, improving the learning situation, and effective use of materials.

CI 5731. Social Studies for the In-Service Elementary/Middle School Teacher. (3 cr; A-F only) Prereq–Elem/ middle school teaching exp or #) 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 status at state where appropriate.

CI 5741. Introduction to Social Studies Education. (3 cr; A-F only. Prereq–Social studies init lic 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 init lic 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 init lic 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; competing 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; A-F only. Prereq–Secondary social studies init lic 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–MED 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 5765. Teaching About Newspapers in the Classroom. (3 cr)
Use of daily newspaper in the classroom. Instructional strategies, curriculum development techniques, and teaching materials useful in teaching about newspaper in elementary/secondary classrooms.


CI 8075. Seminar: Art Education. (2 cr; A-F only. Prereq–Edug grad student or #) Reports, evaluation of problems, and review of recent literature.

CI 8079. Research in Art Education. (3 cr; A-F only. Prereq–Edug grad student or #) Critical. Research current agenda. Helps students identify research questions and choose appropriate methodologies.

CI 8095. Problems: Art Education. (1-12 cr. Prereq–#) Prereq–Grad art educ major or grad student) 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) 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.

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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 as 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 student]
Central concepts, ideas, and debates in professional field of curriculum. Critical discussion about curriculum in general education to lay a foundation for student research and innovation in a particular school subject or related field.

CI 8132. Curriculum and Instruction Core: Teaching Theory and Research. [3 cr; A-F only. Prereq–CI PhD student]
Overview of research on teaching: historical perspective, modern research and findings, and implications for practice and future research.

CI 8133. Research Methods in Curriculum and Instruction. [3 cr; A-F only. Prereq–CI PhD student]
Survey of educational research methods and comparison of underlying assumptions and 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 NUDIST NVivo software. Students interpret analyzed material and complete an article length document that includes a review of related research/methodology.

CI 8150. Topics in Research in Curriculum and Instruction. [1-6 cr [max 12 cr]. Prereq–[MA or EdD or PhD student or #]
Special topics, current research trends in curriculum/ instruction. Research review, subject integration, curriculum contexts, development, implementation, data collection, analysis, evaluation.

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 of Colleges in Education. [3 cr. Prereq–CI grad student or #]
Goals, instructional strategies, evaluation procedures, and professional considerations.

CI 8195. 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 other college or university.

CI 8197. Problems: Curriculum Studies. [1-4 cr [max 8 cr. Prereq–MA student]
Directs students to completing Plan B paper for M.A. degree.

CI 8198. Problems: Teacher Education. [1-6 cr [max 12 cr]. Prereq–#]
Independent research.

CI 8333. FTE: Master’s. [1 cr; NG. Prereq–Master’s student, adviser approval, DGS 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 planning in service to student, 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. Research in Reading. [3 cr. Prereq–#]
Significant literacy research, critical analysis of methodology and findings, appraising research methods, population limitations, and educational implications.

CI 8421. Research in Composition. [3 cr. Prereq–#]

CI 8444. FTE: Doctoral. [1 cr; NG. Prereq–Doctoral student, adviser approval, DGS 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. 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. Prereq–#]
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]

CI 8691. 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 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 8888. Thesis Credits: Doctoral. [1-24 cr [max 100 cr. NG]

Dance

Department of Theatre Arts and Dance
College of Liberal Arts

Dnc 5010. Modern Dance Technique 7. [2 cr [max 4 cr. Prereq–Audition registration not permitted]
Continuation of technical development. Performance range/style. Students study with various guest artists.

Dnc 5020. Modern Dance Technique 8. [2 cr [max 4 cr. Prereq–5010 or A. Audition registration not permitted]
Continuation 5010. Performance range/style. Students study with various guest artists.

Dnc 5110. Ballet Technique 7. [2 cr [max 4 cr. Prereq–Audition registration not permitted]
Continuation of ballet technique. Muscularity, performance, stylistic differences. Practical work conducted within context of choreographic/aesthetic development of ballet.

Dnc 5120. Ballet Technique 8. [2 cr [max 4 cr. Prereq–5110 or A. Audition registration not permitted]
Continuation of 5110. Muscularity, performance, stylistic differences. Practical work conducted within context of choreographic/aesthetic development of ballet.
Dent 5210. Jazz Technique 7. (1 cr; max 2 cr. Prereq—Δ; audit registration not permitted) Continuation of jazz technique. Syncopation, performance projection. Specific styles: swing, bebop, lyrical, funk, latin.

Dent 5220. Jazz Technique 8. (1 cr; max 2 cr. Prereq—5210 or Δ; audit registration not permitted) Continuation of 5210. Syncopation, performance projection. Specific styles: swing, bebop, lyrical, funk, latin.

Dent 5500. Topics in Dance. (1-3 cr [max 10 cr]) Topics specified in Class Schedule.


Dent 5700. Performance. (1 cr [max 4 cr]. Prereq—Δ; techniques course, Δ) Technique, improvisation, choreography, music, design, and technical production as they relate to dance performance.

Dent 5858B. Teaching Dance. (4 cr. Prereq—1020, Δ or #) Methods, principles, and techniques of teaching dance.

Dent 5970. Directed Studies. (1-4 cr [max 10 cr]). Prereq—Δ, Δ) 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 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) Introduce the scientific foundation of dentistry. 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 phenomenon occurring in the oral cavity and the interrelationships between these phenomenon. 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) 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. Prereq—Satisfactory completion of Dent 5321) 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, Epidemiology, and Prevention. (3 cr; A-F only) Dental public health. Epidemiology, biostatistics, professional ethics, financing of dental care, health economics, health policy. Students participate in site visits and search and manage, and evaluate dental information and practice current utilization of materials. April, students in research/present materials about oral health topic.

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 5411. Periodontology II, 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, dental, 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 Techniques. (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. (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 periapical 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 retentive/resistant restorations, conserving tooth structure, and operating in clinically relevant orientations. Self-evaluation techniques, discriminatory skills.


Dent 5804. Operative Dentistry II Laboratory. (3 cr; A-F only. Prereq—5802) Exercises in treatment of moderate to severe phase of dental caries utilizing dental amalgam, cast gold, composite resin, and cast porcelain. Aesthetic modifications to teeth.

Dent 5805. Operative Dentistry III. (3 cr; A-F only. Prereq—5801, 5802, 5803, 5804) Integration/application of skills/knowledge in diagnosis, treatment planning, and treatment. Clinical setting.

Dent 5901. Oral Anatomy I. (4 cr [max 4 cr]; A-F only) Tooth morphology, nomenclature, classification, charting, calculation, and eruption sequences; mouth growth and development.


Dent 5903. Preclinical Prosthodontics Technique Lab I. (3 cr; A-F only. Prereq—4848, 4949) Demonstration of clinical and lab procedures.

Dent 5904. Preclinical Prosthodontics Technique Lecture and Laboratory II. (4 cr; A-F only. Prereq—5901, 5902, 5903) Lab techniques, fundamentals of tooth preparation.
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Dent 5905. Preclinical Prosthodontic Technique Lecture III. (3 cr; F-A only. Prereq–4848, 4949, 4950, 4951, 4952) Second-year preclinical courses to include fixed, removable, and occlusion topics.

Dent 5906. Preclinical Prosthodontic Technique Lab III. (6 cr; F-A only. Prereq–4848, 4949, 4950, 4951, 4952) Fixed, removable, and occlusion topics.

Dent 5907. Preclinical Prosthodontic Technique Lecture IV. (3 cr; F-A only. Prereq–4848, 4949, 4950, 4951, 4952, 4953) Fixed, removable, and occlusion topics.

Dent 5908. Preclinical Prosthodontic Technique Lab IV. (6 cr; F-A only. Prereq–4848, 4949, 4950, 4951, 4952, 4953, 4954) Fixed, removable, and occlusion topics.

Dent 5909. Preclinical Prosthodontic Technique Lecture V. (2 cr; F-A only. Prereq–4848, 4949, 4950, 4951, 4952, 4953, 4954, 4955, 4956) Fixed, removable, and occlusion topics.

Dent 5910. Preclinical Prosthodontic Technique Laboratory V. (2 cr; F-A only. Prereq–4848, 4949, 4950, 4951, 4952, 4953, 4954, 4955) Fixed, removable, and occlusion topics.

Dent 8031. Topics and Problems in Dental Education. (1-3 cr) Independent study in student learning, instructional development, curriculum planning, student testing and evaluation, and academic administration, where these areas and their interfaces are applied directly to professional dental education. Provides opportunity for applying and extending concepts learned in Dent 7033.

Dent 8090. Evidence-based Clinical Pediatric Dentistry. (2 cr; F-A only) Selected pediatric dentistry topics. In-depth literature review, seminar discussion.

Dent 8091. Interdisciplinary Care of the Cleft Palate Patient. (1 cr; S-N only) Comprehensive surgical, dental, and speech and hearing evaluation and management of patients with cleft lip and palate.

Dent 8100. Topics in Advanced Periodontology: Literature Review. (2 cr) State-of-the-art information on a variety of topics concerning risk factors and therapeutic modalities for periodontal disease.


Dent 8120. Advanced Principles and Techniques of TMJ and Orofacial Pain Disorders. (3 cr; F-A only. Prereq–Participation in TMJ and orofacial pain advanced education program) Interdisciplinary study of theory, principles, epidemiology, and mechanisms associated with TMJ and craniofacial pain disorders and a basis for scientific understanding of diagnostic and management strategies for them.

Dent 8121. Current Literature in TMJ and Craniofacial Pain. (1 cr; F-A only) Review of current literature and of how it relates to past literature, theories on pain, and philosophies of management.

Dent 8123. Advanced Topics in Orofacial Pain. (3 cr; F-A 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; NRA. Prereq–Master’s student, advisor, and DDS consent)

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

Dermatology (Derm)

Department of Dermatology
Medical School

Derm 8225. Clinical Dermatology. (7 cr)
Derm 8226. Clinical Seminar. (1 cr)
Derm 8227. Histology of the Skin. (1 cr)
Derm 8230. Functional Biology of the Skin. (1 cr)
Derm 8232. Seminar: Dermatologic Histopathology and Mycology. (1 cr)

Design Institute (Desl)

College of Architecture and Landscape Architecture

Desl 5100. Design Institute Directed Study. (1-3 cr [max 6 cr]; F-A 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; F-A 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]; F-A only. Prereq–Depends on topic, check with dept) In-depth investigation of a single specific topic, announced in advance.

DHA 5193. Directed Study in Design, Housing, and Apparel. (1-4 cr; F-A only) Independent study in design, housing, and apparel under tutorial guidance.

DHA 5196. Field Study: National/International. (1-10 cr [max 10 cr]; F-A only. Prereq–#) Faculty-directed field study in a national or international setting.

DHA 5216. Textile and Apparel Consumer. (3 cr; F-A only. Prereq–[2101, 2213] or [jr or sr or grad student]) Consumer actions concerning textile/clothing products for home and other physical interiors. Personal use as part of daily living in different social, economic, and cultural settings, nationally and internationally.

DHA 5381. Digital Illustration. (3 cr; F-A 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; F-A 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; F-A 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; F-A 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 5388. Design Planning, Analysis, and Evaluation. (3 cr; F-A only. Prereq–[4354, DHA major] or grad or #) Preliminary research, including theoretical, applied, and legal aspects. Planning/developmental models. Design prototyping, testing, and analysis.

DHA 5399W. Theory of Electronic Design. (3 cr; F-A only. Prereq–[DHA major, sr] 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; F-A only. 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 5467W. Housing and the Social Environment. (4 cr; F-A 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 5471. Housing Studies Certificate Seminar. (2 cr; F-A 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; F-A 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; F-A 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 8101. Philosophical Foundations of Design, Housing, and Apparel. (4 cr; F-A only) The nature of thought underlying and within professional areas of the field.

DHA 8103. Methodological Orientations: Qualitative Research. (3 cr; F-A 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. Analysis of Design Literature. (3 cr; F-A only) Classic and contemporary literature; visualization, creativity, and design methods literature.

DHA 8112. Design Theory and Criticism. (3 cr; F-A 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 Studios. (3 cr; F-A only) Educational processes and methods used in design studio courses. Learning styles, team projects, criticism, evaluation, and curriculum development.

DHA 8114. Design Studio. (4 cr; F-A only. Prereq–#) Advanced problem analysis, design solution.