BRAE 463 Undergraduate Seminar (1)
Group discussion of current agricultural engineering topics presented by
individual members of the class and visitors. Placement opportunities and
requirements. 1 seminar.

BRAE 464 Professional Practice (3)
Contracts, specifications, and legal aspects of agricultural engineering.
Safety and human factors. Engineering ethics and professional registration.
3 lectures. Prerequisite: Senior standing.

BRAE 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to
undergraduate and graduate students. The Schedule of Classes will list topic
selected. Total credit limited to 8 units. 1–4 lectures. Prerequisite: Consent
of instructor.

BRAE 471 Selected Advanced Laboratory (1–4)
Directed group laboratory study of selected topics for advanced students.
Open to undergraduate and graduate students. The Schedule of Classes will
list topic selected. Total credit limited to 8 units. 1–4 laboratories.
Prerequisite: Consent of instructor.

BRAE 481 Advanced Agricultural Mechanics (2)
Advanced shop skills. Carpentry, electricity, plumbing, surveying, power
mechanics, tractor equipment operation and maintenance. 1 lecture, 1
laboratory. Prerequisite: Agricultural teacher candidates starting/returning
from student teaching, senior or graduate standing or consent of instructor.

BRAE 485 Cooperative Education Experience in BioResource and
Agricultural Engineering (6) (CR/NC)
Part-time work experience with an approved BioResource and Agricultural
Engineering firm engaged in production or related business, industry or
governmental agency. Positions are paid and usually require relocation and
registration in course for two consecutive quarters. Formal report and
evaluation by work supervisor required. Total credit limited to 16 units.
Degree credit limited to 6 units. Credit/No Credit grading only.
Prerequisite: Sophomore standing and consent of instructor.

BRAE 495 Cooperative Education Experience in BioResource and
Agricultural Engineering (12) (CR/NC)
Full time work experience with an approved BioResource and Agricultural
Engineering firm engaged in production or related business, industry or
governmental agency. Positions are paid and usually require relocation and
registration in course for two consecutive quarters. Formal report and
evaluation by work supervisor required. Total credit limited to 16 units.
Degree credit limited to 6 units. Credit/No Credit grading only.
Prerequisite: Sophomore standing and consent of instructor.

BRAE 500 Individual Study (1–3)
Advanced study planned and completed under the direction of a member of
the department faculty. Open only to graduate students who have
demonstrated ability to do independent work. Enrollment by petition. Total
credit limited to 6 units, repeatable in same term. Prerequisite: Consent of
instructor.

BRAE 521 Systems Analysis of Agricultural Systems (4)
Principles and methods of creative problem solving and systems analysis as
applied to the design of agricultural systems. Problem solving using the
engineering design process to analyze the need, establish boundaries, and
generate creative alternative solutions. Examples worked through in
feasibility analysis, transportation and network problems, linear
programming, project planning, human factors and ergonomics, and system
analysis with an emphasis on optimum system operation. 3 lectures, 1
laboratory. Prerequisite: Consent of instructor.

BRAE 522 Instrumentation Control/Microprocessors (4)
Engineering input/output instrumentation for sensing and controlling
functions through data acquisition, analysis and response to agricultural
processing. 3 lectures, 1 laboratory. Prerequisite: BASIC language
programming or consent of instructor.

BRAE 529 Small Farm Mechanization (3)
Principles of farm machinery used for tillage, seeding, weeding, harvesting
and transport of agricultural crops. Small-scale equipment, suitable for
subsistence farming in developing countries. Small tractors, hand tools,
animal power, and fuel from renewable sources. 2 lectures, 1 laboratory.
Prerequisite: BRAE 143 or equivalent, graduate standing, or consent of
instructor.

BRAE 532 Water Wells and Pumps (4)
Water well drilling, design, and development. Pump characteristics and
system head. Series and parallel operation. Design of pump intakes.
Variable speed electric drives and engines. Pump testing. 3 lectures, 1 labora-
tory. Prerequisite: BRAE 340 or equivalent, or BRAE 312 or equivalent.

BRAE 533 Irrigation Project Design (4)
Engineering solutions and social aspects of improved water delivery to
farms and canal automation. Flow measurement. Water user associations.
Unsteady canal and pipeline controls. PID controls and modeling. 3
lectures, 1 laboratory. Prerequisite: BRAE 340, hydraulics/fluid mechanics.

BRAE 570 Selected Topics in BioResource and Agricultural
Engineering (1–4)
Directed group study of selected topics for advanced students. Open to
undergraduate and graduate students. The Schedule of Classes will list topic
selected. Total credit limited to 12 units. 1 to 4 seminars. Prerequisite:
Graduate standing or consent of instructor.

BRAE 571 Selected Advanced Laboratory in BioResource and
Agricultural Engineering (1–4)
Directed group laboratory study of selected topics for advanced students.
Open to undergraduate and graduate students. The Schedule of Classes will
list topic selected. Total credit limited to 8 units. 1–4 laboratories.
Prerequisite: Consent of instructor.

BRAE 581 Graduate Seminar in BioResource and Agricultural
Engineering (3)
Group study of current problems of the bioresource and agricultural
engineering industry; current experimental and research findings as applied
to field of bioresource and agricultural engineering. The Schedule of
Classes will list topic selected. Total credit limited to 9 units. 3 seminars.
Prerequisite: Graduate standing or consent of instructor.

BRAE 599 Thesis in BioResource and Agricultural
Engineering (1–9)
Systematic research of a significant problem in bioresource and agricultural
engineering. Thesis will include problem identification, significance,
methods, data analysis, and conclusion. Students must enroll every quarter
in which facilities are used or advisement is received. Degree credit limited
to 6 units. Prerequisite: Graduate standing and consent of instructor.

BUS–BUSINESS

BUS 100 Student Orientation and College Success (2) (CR/NC)
Designing a successful four-year plan for graduation. Orientation of all
OCOB majors to student’s academic program including development of
four-year graduate plan and orientation to the OCOB mission and values.
Exploration of skills needed for success: time management, adjustment to
college life, study skills, career planning and concentration selection,
diversity in school, business and beyond, and academic politics. Credit/No
Credit grading only. 1 lecture, 1 activity.

BUS 200 Special Problems for Undergraduates (1–4)
Individual investigation, research, studies, or surveys of selected problems.
Total credit limited to 4 units. Prerequisite: Consent of area coordinator.

BUS 207 Legal Responsibilities of Business (4)
Examination of the American legal system and important legal principles
for business operations, such as those involved with contracts, torts,
tort, agency, business organizations, and employment. Emphasis on how legal
principles help define socially responsible conduct. Case studies. 4 lectures.
BUS 212 Financial Accounting for Nonbusiness Majors (4)  
Introduction to financial accounting theory and practice with an emphasis on financial statement preparation and analysis. Not open to Business majors. 4 lectures.

BUS 214 Financial Accounting (4)  
Principles of financial accounting for Business majors. The course prepares students to understand and interpret financial statement information. Financial reporting standards are explored to give students an understanding of how financial events are reflected in financial statements. The course explores the importance of social responsibility in accounting through spreadsheet applications and Internet resources. 4 lectures.

BUS 215 Managerial Accounting (4)  
Applications of accounting for making business decisions. Content includes planning and control issues including cost behavior, budget preparation, performance reporting; addresses social responsibility and employee motivational and behavioral considerations. Preparation of spreadsheet applications useful for decision-making. 4 lectures. Prerequisite: Demonstrated competency in electronic spreadsheet, word processing, and presentation applications. BUS 212 or BUS 214 or equivalent.

BUS 290 Business Programming (4)  
Fundamentals of computer programming related to business applications. Application development using graphical user interface controls, variables, data types, and input/output with text files. 4 lectures.

BUS 302 International and Cross Cultural Management (4)  
Dimensions of culture and its variations within and across nations. Impact of culture on managing in a global context. Development of managerial competencies requisite to working in and supervising multicultural groups in international corporations. Frameworks for analyzing cultural and contextual influences on organizational behavior, culture shock and readjustment, expatriation and repatriation, cultural change and innovation, intercultural conflict, and ethical dilemmas. Case studies, behavioral simulations, self-assessments and fieldwork. 4 lectures. Prerequisite: GE Area A, C1, C2, D1-D4, ECON 222, and BUS 207, or consent of instructor.

BUS 303 Introduction to International Business (4)  
Special terms, concepts, and institutions associated with the environment in which international companies operate. Students will be enabled to understand, analyze and offer solutions to global business problems. 4 lectures. Prerequisite: A grade of C- or better in ECON 222.

BUS 308 Business Law II (4)  
Legal aspects of management decisions, including problems arising in sales, commercial paper, personal property and bailments, secured transactions, bankruptcy, and securities regulation, with emphasis on the uniform commercial code. Case studies. 4 lectures. Prerequisite: BUS 207 or equivalent.

BUS 310 Introduction to Entrepreneurship (2-4)  
Role and impact of entrepreneurship; characteristics and traits of entrepreneurs; social, economic, cultural and policy conditions conducive to entrepreneurship; entrepreneurial thinking; opportunity identification and assessment; the management team; organizational and legal issues; business models; acquiring social and financial capital; managing startup to growth; entrepreneurial behavior in existing organizations; realizing and harvesting value. Total credit limited to 4 units. 2-4 lectures. Prerequisite: BUS 207 or equivalent.

BUS 311 Managing Technology in the International Legal Environment (4)  
Analysis of U.S. and international laws regarding technological innovations from economic, social and political perspectives. Copyrights, patents, trademarks, trade secrets, contracts, products liability and privacy. The Internet, computer programs and biotechnology. 4 lectures. Prerequisite: Completion of GE Areas A, D1 and D2. Business Administration majors will not receive GE Area D5 credit.

BUS 319 Accounting Information Systems (4)  
Comprehensive coverage of manual and computerized accounting processes and internal controls. Documenting information systems. Identifying control weaknesses within information systems to comply with Sarbanes-Oxley Act. 3 lectures, 1 activity. Prerequisite: BUS 214.

BUS 320 Taxation of Business Entities (4)  
Federal income taxation of the various forms of business entities. Introduction to broad range of tax concepts and types of taxpayers. Role of taxation in the business decision-making process. 4 lectures. Prerequisite: BUS 212 or BUS 214 and BUS 319 or consent of instructor.

BUS 321, 322 Intermediate Accounting I, II (4) (4)  
Comprehensive coverage of financial reporting issues. BUS 321 covers financial statements, assets other than investments and intangibles, and liabilities. BUS 322 covers investments, intangibles, equities, revenue recognition and the Cash Flows Statement. 4 lectures. Prerequisite: BUS 321; BUS 214; BUS 319; BUS 322; BUS 321 with minimum grade of C-. Changed effective Fall 2008; see Updates.

BUS 343 Quantitative Methods in Finance (4)  
Basic mathematical foundations for advanced courses in finance: mathematical finance -- dealing with elementary materials (time value of money, single multiple period portfolio choice, and application of arbitrage), and risk management -- dealing with value-at-risk, stressing current industry practices. 4 lectures. Prerequisite: STAT 252.

BUS 346 Principles of Marketing (4)  
Introduction of the marketing process: identifying target markets; developing and launching products or services; and managing pricing, promotion, and distribution strategies. Focus on leveraging technologies that result in innovation and impact marketing practice. Recognition that markets are global. Ethics and social responsibility in marketing decision-making. 4 lectures. Prerequisite: A grade of C- or better in all of the following: ECON 222, MATH 221, STAT 252, BUS 215.

BUS 350 The Global Environment (4)  
GE Area F  
(Also listed as AG/EDES/ENGR/HUM/SCM/UNIV 350)  
Interdisciplinary investigation of how human activities impact the Earth’s environment on a global scale. Examination of population, resource use, climate change, and biodiversity from scientific/technical and social/economic/historical/political perspectives. Use of remote sensing maps. Sustainable solutions. 3 lectures, 1 activity. Prerequisite: Completion of GE Areas A and B and junior standing.

BUS 360, 361 Undergraduate Integrated Core Curriculum I, II (12) (12)  
The foundation knowledge and skills required of all business concentrations. Integration of accounting, finance, marketing, operations management, government and social influences. Organizational behavior and international topics in one two-quarter curriculum, based on the approved business core. 10 lectures, 2 activities per course. Prerequisite: BUS 207, BUS 214, BUS 215, BUS 391, ECON 221, ECON 222, MATH 221, STAT 251, STAT 252.

BUS 382 Organizations, People, and Technology (4)  
Organizations as sociotechnical systems. Examination of macro dimensions of organizations including environment, mission, goals, structure, people, technology, and internal management systems and processes. Case analysis, experiential class activities. Application to technology-oriented business settings. 4 lectures. Prerequisite: GE Area A, C1, C2, D1-D4. Changed effective Fall 2008; see Updates.

BUS 384 Human Resources Management (4)  
Introduction to functional areas of the discipline including staffing, compensation, employee development and labor relations. Additional workplace issues addressed include performance and human capital management, employer legal and social responsibility for employee...
wellbeing, managing a diverse/global workforce, and using human resource information systems. 4 lectures. Prerequisite: GE Area A, C1, C2, D1-D4, ECON 221 and BUS 207.

BUS 386 Employee Performance and Knowledge Management (4)
Needs assessment, including organization, person, and task or competency analysis. Design, delivery and evaluation of employee training and human resource development in knowledge-based organizational settings. Performance management and feedback systems; development of learning organizations; human resource information systems (HRIS) applications in career management and training administration. 4 lectures. Prerequisite: BUS 384.

BUS 387 Organizational Behavior (4)
Application of behavioral, social and organizational science concepts to management. Exploration of the interactions between individuals and the organizations in which they work and live. Individual, interpersonal, team, intergroup and organizational levels of analysis included in topics such as expectations, perception, communications, creativity, leadership style, cultural and ethical behavior, group dynamics, team effectiveness and work design. 4 lectures. Prerequisite: GE Area A, C1, C2, D1-D4, ECON 221 and BUS 207. Recommended: STAT 252.

BUS 390 Data Structures for Business Systems (4)
The use of algorithmic processes related to business practices. Analysis techniques for managing data structures such as lists, stacks, queues and trees. Algorithms to perform common programming tasks such as sorting, searching and hashing. Emphasis on the use of data structures from object class libraries in projects and exercises. 4 lectures. Prerequisite: CPE/CSC 101 or CSC 237 (with a grade of C– or better), or BUS 290 (with a grade of C– or better), or consent of instructor.

BUS 391 Information Systems (4)
Computer applications in business and industry. Information systems and integrated systems concepts, computer hardware and software, strategic uses of information systems, databases, data warehousing, decision support systems and artificial intelligence, network basics, electronic communication, systems development, ethical use of information, employing technology in a socially responsible manner, and emerging trends and technologies in information systems. 4 lectures. Prerequisite: BUS 215.

BUS 393 Database Structures in Business (4)
Design, development, testing, and implementation of databases for business applications. Data modeling with entity relationship diagrams (ERD) and class diagrams (UML). Data normalization, data integrity, the effect of business rules on data normalization. Advanced queries using structured query language (SQL). Database application development culminating in a database project. 4 lectures. Prerequisite: BUS 390 or CSC 103 and BUS 391. Changed effective Fall 2008; see Updates.

BUS 394 System Analysis and Design (4)
Systems analysis and design. Project team creation and performance monitoring. Systems development life cycle and project management, process modeling using data flow diagrams, data modeling with E/R diagrams, CASE tools, object modeling with UML, and prototype development. 4 lectures. Prerequisite or concurrent: BUS 393 (grade of C- or better).

BUS 395 Systems Design and Implementation (4)
Systems design and implementation, with focus on project management and incorporating software quality into the software development process, including software testing. 4 lectures. Prerequisite: BUS 393 and BUS 394 (both with a minimum grade of C– or better).

BUS 400 Special Problems for Advanced Undergraduates (1–4)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units. Prerequisite: Senior standing or consent of instructor.

BUS 401 Seminar in General Management and Strategy (4)
Application of interdisciplinary skills to business and corporate strategy formulation and implementation. Analysis of interdependence between external environments and internal systems. Focus on responsibilities, tasks, and skills of general managers, including socially responsible behavior and governance. Case studies, group problem solving. Capstone course of Business core curriculum. 4 seminars. Prerequisite: A grade of C-or better in all 300-level Business core courses, BUS 342, BUS 346, IT 371, BUS 387, BUS 391, and senior standing.

BUS 402 International Business Management (4)
Managerial concepts and techniques for analysis and decision making within international businesses. Environmental and organizational factors influencing multinational operations. Assessing international market opportunities and entry modes. Complexities of multinational management strategy, structure and systems, especially during initial stages of internationalization. Case studies and simulations. 4 lectures. Prerequisite: BUS 342, BUS 346, BUS 387 or consent of instructor.

BUS 403 Advanced Seminar in International Management (4)
Integration of management concepts within complex multinational organizations. Interdisciplinary approach to identifying and assessing multinational and global competitive environments and strategies; structuring and managing interdependent multinational operations; addressing conflicts between domestic and international policies and practices in multinational enterprises. Case studies, simulations, group analysis and problem solving. 4 seminars. Prerequisite: BUS 302 and BUS 402 or consent of instructor.

BUS 404 Governmental and Social Influences on Business (4)
Analysis from legal, economic, political, and ethical perspectives, of the changing domestic and international environments of the business enterprise. Topics include administrative law, agencies and regulatory policy, antitrust law, public policy analysis, business-government relations, and corporate responsibility. Case studies. 4 lectures. Prerequisite: BUS 207 and ECON 222.

BUS 405 Joint Ventures and Alliances (4)
Examination of joint ventures and alliances between organizations, using cross-cultural, interdisciplinary perspective. Alliance motives, types and traits. Processes for partner selection, negotiation, structure, operation, and performance assessment of international and cross-cultural alliances. Lectures, case studies, and simulation. 4 lectures. Prerequisite: BUS 342, BUS 346, and BUS 387.

BUS 406 Managing Mergers, Acquisitions and Divestitures (4)
Issues associated with analyzing, negotiating, and managing mergers, acquisitions and divestitures (MADS) using cross-cultural, interdisciplinary perspective. Rationale for decision to pursue MADS and processes for identifying targets; valuing and negotiating MADS; staffing and human resource management issues; strategic control and integration; and cross-cultural conflict and divided loyalties in domestic and international MADS. Lectures, case studies and simulation. 4 lectures. Prerequisite: BUS 342, BUS 346, and BUS 387.

BUS 407 Managing People in Global Markets (4)
Impact of cultural and strategic differences on management of people in multinational organizations. Critical human resource issues in domestic and international operations. 4 lectures. Prerequisite: BUS 387.

BUS 409 Law of Real Property (4)
Legal problems of acquisition, ownership and transfer of real property. Contracts, agency, estates, and co-ownership, mortgages and deeds, covenants, conditions, and restrictions, easements, landlord-tenant, and zoning. 4 lectures. Prerequisite: Senior standing.

BUS 410 The Legal Environment of International Business (4)
U.S., foreign, and international law affecting international business transactions. U.S. and foreign cultural, ethical, and political norms and legal institutions, and their effect on law and business. 4 lectures. Prerequisite: BUS 207 and ECON 222.

BUS 412 Advanced Managerial Accounting (4)
Product costing systems including hybrid costing systems, management control systems, cost allocation, activity based costing, cost information for decision making, new manufacturing environments, and strategic control
systems. International dimension integrated in the course content. 4 lectures. Prerequisite: BUS 215.

**BUS 416 Volunteer Income Tax Assistance (4)**
Coverage of the deductions and credits applicable to individuals. Training and practice in the preparation of state and federal income tax returns. Under supervision of qualified professionals, tax preparation sites are operated to provide free tax assistance to community residents. 2 lectures, 2 activities. Prerequisite: BUS 320 or equivalent, senior standing.

**BUS 417 Taxation of Corporations and Partnerships (4)**
Comparative study of the taxation of C corporations and flow-through tax entities, including S corporations, partnerships and limited liability companies. 4 lectures. Prerequisite: BUS 320 or equivalent.

**BUS 418 Listening to the Customer (4)**
A project-oriented introduction to exploratory, secondary, and qualitative methods. Access and use of secondary sources of information that support marketing decision making and lead to a carefully crafted research plan. Emphasis on qualitative marketing research techniques, with the goal of setting the stage for additional data collection. 4 lectures. Prerequisite: BUS 346.

**BUS 419 Strategic Marketing Measurement (4)**
Gathering, analyzing, and reporting information critical for marketing decision making. Focus on primary data collection and analytical techniques including experimental design, descriptive statistics, chi-square analysis, ANOVA, and regression. Other methods may include data mining, GIS, and customer relations management (CRM). 4 lectures. Prerequisite: BUS 418, STAT 252. Changed effective Fall 2008; see Updates.

**BUS 420 Advanced Financial Reporting (4)**
Comprehensive coverage of selected advanced financial accounting and reporting topics. Topics include revenue recognition, software development costs, employee stock option plans, pensions and post-retirement benefit plans, accounting for income taxes, leases, specialized inventory issues and advanced consolidation issues. 4 lectures. Prerequisite: BUS 322.

**BUS 422 Government and Not-For-Profit Entities (4)**
Accounting and reporting by state and local governments and not-for-profit entities. State and local governmental topics include: fund structures, budgetary accounting, the modified accrual basis of accounting, reporting entity issues. Not-for-profit topics include: financial and reporting concepts and practices, contributions, restricted resources, endowments. 4 lectures. Prerequisite: BUS 321.

**BUS 424 Professional Accounting (4)**
Development of the accounting profession. Past, present and future. Emphasis on contemporary issues confronting the professional accountant and his/her social and ethical responsibilities and opportunities. 4 lectures. Prerequisite: Consent of instructor.

**BUS 425 Auditing (4)**
Survey of the auditing environment including institutional, ethical, and legal liability dimensions. Introduction to audit planning, assessing materiality and audit risk, collecting and evaluating audit evidence, considering the internal control structure, substantive testing, and reporting. 4 lectures. Prerequisite: BUS 322.

**BUS 427 International Accounting (4)**
Consideration of conceptual, managerial, professional and institutional issues of international accounting. 4 lectures. Prerequisite: BUS 321 or equivalent.

**BUS 428 Accounting Policy (4)**
Role of management in establishing and directing accounting policy. Coverage includes impact of management decisions on external reporting and taxes and the impact of financial reporting requirements on management decisions. 4 seminars. Prerequisite: BUS 322.

**BUS 429 Accounting Process Analysis (4)**
Coverage of revenue, purchasing, human resources and payroll, integrated production, and general ledger and business reporting processes in enterprise systems. A risk management approach to evaluate key business and accounting processes. E-business concepts. 3 lectures, 1 activity. Prerequisite: BUS 215 and BUS 321 with a minimum grade of C–.

**BUS 430 Internship/Cooperative Education (2–12) (CR/NC)**
Work experience in business, industry, government and other areas of student career interest. Periodic written progress reports, final report, and evaluation by work supervisor required. Credit/No Credit grading. Total credit limited to 16 units. Prerequisite: Approval of area chair, junior standing, and a CPSLO cumulative GPA of at least 2.5 without being on academic probation.

**BUS 431 Security Analysis and Portfolio Management (4)**
In-depth analysis of equity market and its instruments. Detailed study of leading stock valuation models. Impact of changes in the firm’s fundamentals and in macroeconomic factors on stock prices. Brief introduction to equity and index derivatives. 4 lectures. Prerequisite: BUS 342. Changed effective Fall 2008; see Updates.

**BUS 432 Insurance Planning and Risk Management (4)**
Introduction to insurance planning and risk management and its role in financial planning. Key concepts include determining risk exposure and selecting insurance products. Legal aspects of property and liability policy, life, health, and social insurance. 4 lectures. Prerequisite: BUS 342.

**BUS 433 International Finance (4)**
Financial management of international business. International capital and money markets, international financial institutions, special problems in evaluating direct foreign investment, and financial techniques used in international business operations. 4 lectures. Prerequisite: BUS 342.

**BUS 434 Real Estate Finance (4)**
Intensive investigation and computer analysis of real estate investment opportunities. Problems in real estate and property management. 4 lectures. Prerequisite: BUS 342.

**BUS 436 Entrepreneurial Finance (4)**
Process of financing new and fast-growing firms. Readings on the venture capital process, from seed capital through the initial public offering. Valuation of firms seeking venture capital, and those planning their initial public offering. Valuing convertible securities. Real options valuation. 4 seminars. Prerequisite: BUS 342.

**BUS 437 Retirement and Estate Planning (4)**
Retirement planning and employee benefits; Social Security and Medicare; types of retirement plans; qualified plan characteristics; distribution options; and group insurance benefits. Trusts, power of attorney, and probate. 4 lectures. Prerequisite: BUS 342.

**BUS 438 Advanced Corporate Finance (4)**
Corporate finance with an emphasis on managing the corporation to create shareholder value. Detailed treatment of topics such as capital budgeting, capital structure, economic value-added, corporate distribution policy, financial distress, and mergers and acquisitions. 4 lectures. Prerequisite: BUS 431 and BUS 439.

**BUS 439 Fixed Income Securities and Markets (4)**
Development of analytical skills for properly valuing fixed income securities. Bond pricing, yields, and volatility; interest rate term structure and yield curve; securities, market structure, and analytical techniques; bond portfolio strategies and an introduction to interest rate derivatives. 4 lectures. Prerequisite: BUS 342. Changed effective Fall 2008; see Updates.

**BUS 440 Commercial Bank Management (4)**
Analysis of the management of a commercial bank as a profit-making entity. Emphasis put on cases in bank management, especially those which deal with the management of a bank's asset and liability structure. 4 lectures. Prerequisite: BUS 342 and ECON 337.
BUS 441  Computer Applications in Finance (4)
A combination lecture/computer lab course focusing on computer acquisition of financial data and the subsequent application of financial theory and analysis to this data so as to facilitate financial decision making. 3 lectures, 1 activity. Prerequisite: BUS 342.

BUS 442  Introduction to Futures and Options (4)
An in-depth analysis of derivatives markets and instruments. Emphasis on the valuation of futures, options, swaps, and other derivative securities. 4 seminars. Prerequisite: BUS 431.

BUS 443  Case Studies in Finance (4)
Development of analytical and decision-making techniques in applying financial theory to business management problems. Emphasizes working capital management, financial analysis and forecasting, mergers and acquisitions, and other current topics in finance, including financial ethics. Cases are used to emphasize practical problems. 4 lectures. Prerequisite: BUS 431, BUS 438, and BUS 439.

BUS 444  Financial Engineering and Risk Management (4)
Advanced course synthesizes concepts from corporate finance, derivative securities, statistics, and computer science. Emphasis on both computer programming in a matrix programming language (Matlab) to solve practical risk management and valuation problems, and analytical training in the area of stochastic calculus, and its application to derivative security pricing. Practical applications of derivatives for controlling risk in an international corporate environment. 4 lectures. Prerequisite: BUS 343, BUS 422 or BUS 433, CSC 234 or equivalent.

BUS 445  Ethics and Behavioral Finance (4)
Contemporary theoretical and empirical issues including agency theory, reputation building, game theory, and financial ethics. Discussion of the application of ethics theory to financial decisions. May include lectures, case analyses, student presentations, and guest speakers. 4 lectures. Prerequisite: BUS 342.

BUS 446  International Marketing (4)
Basic skills and tools needed to evaluate the cultural factors that impact the acceptance of products and services in markets around the world. Building of an understanding of global marketing strategy. 4 lectures. Prerequisite: BUS 346.

BUS 451  Product Development and Launch (4)
Building of project-based skills in developing new products and planning for their launch. Major phases of product development: opportunity identification, product design and positioning, pre-market testing and forecasting, and launch marketing. Introduction to data-gathering methods used to design well differentiated and successful products. 4 lectures. Prerequisite: BUS 419.

BUS 452  Product Management (4)
Development of project-based skills in managing products in the growth, maturity, and decline stages of their life cycles. Emphasis on the distribution, pricing, and communication strategies required to maintain distinctive product advantages. Product modification, product line strategies, and pruning. 4 lectures. Prerequisite: BUS 419.

BUS 453  Developing and Presenting Marketing Projects (4)
Client-based course providing an opportunity to apply marketing abilities. Teams draw upon research, analytical, and strategic marketing skills to develop an actionable plan that addresses a critical marketing challenge faced by an organization. Deliverables include research findings and written and verbal presentation to the organization and instructor. 4 lectures. Prerequisite: BUS 451 and BUS 452.

BUS 455  Marketing Management (4)
Integration of key marketing concepts using tools such as computer simulations, readings, and/or case studies. Development and implementation of strategic and tactical decisions for companies and brands. 4 lectures. Prerequisite: BUS 451 and BUS 452.

BUS 456  Industrial Customer Interfacing (4)
Focus on managing aspects of the customer interface for strategic advantage. Emphasis on building and maintaining customer data bases. Establishing and maintaining customer service centers. Providing technical support services. Conference and trade show planning and development. 4 lectures. Prerequisite: BUS 346 or consent of instructor.

BUS 461, 462  Senior Project I, II (2) (2)
Selection and analysis of a problem under faculty supervision. Problems typical of those which graduates must solve in their fields of employment. Formal report is required. Minimum 120 hours total time. Prerequisite: Senior standing.

BUS 463  Senior Project: Applied Accounting and Auditing Research (4)
Practice with multiple authoritative accounting and auditing databases, actual published financial reports, and business writing. Real world accounting and auditing issues, including revenue recognition and ethics issues. Federal and state regulation of securities transactions. Prerequisite: Senior standing, BUS 322 and Graduation Writing Requirement.

BUS 464  Applied Senior Project Seminar (4)
Selection and analysis of business problems and opportunities in directed individual or group-based projects. Problems typical to those which graduates could encounter in their fields of employment. Formal report required. 4 seminars. Prerequisite: Senior standing.

BUS 470  Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1–4 lectures. Prerequisite: Consent of instructor.

BUS 471  Compensation (4)
Design and management of compensation systems. Job analysis, job evaluation, wage and salary surveys, incentive systems, gainsharing, benefit administration, pay equity and legal regulation. Simulation and case study development of a wage structure, pay level and individual raise policies, administrative controls, salary and program budgets. 4 lectures. Prerequisite: BUS 384 and STAT 252, or equivalent.

BUS 472  Labor Relations (4)
Union organizing, negotiation and administration of collective agreements. Simulation of bargaining, grievance, and arbitration processes. 4 lectures. Prerequisite: BUS 384 or equivalent.

BUS 473  Employment Law (4)
Federal and state labor policy as expressed in common law, relevant statutes, and executive orders. Effects upon employees, management, protected groups, and the public. Current rules analyzed in a contemporary and historical context. Understanding important workplace and employment problems. 4 lectures. Prerequisite: BUS 207, BUS 384 or equivalent.

BUS 474  Independent Study in Accounting (4)
Individual investigation, research, study or survey of selected topics in accounting, auditing or taxation. Total credit limited to 8 units, repeatable in the same term. The Schedule of Classes will list topic selected. Prerequisite: BUS 322.

BUS 475  Staffing (4)
Processes by which individuals and organizations become matched to form the employment relationship. Specific issues related to human resources planning, internal and external recruitment and selection. 4 lectures. Prerequisite: BUS 384 and STAT 252, or equivalent.

BUS 477  Organization Development Programs (4)
Analysis of development programs in organizations. Review of development and trends in the field of organizational development. Application of behavioral and organizational science knowledge and social technology to programs in organizations for the purpose of improving effectiveness and sustainability. 4 seminars. Prerequisite: BUS 387 and BUS 382 or consent of instructor.
BUS 478 Organization Design Programs (4)
Impact of changing business environment and strategy on design of organizations. Organization design programs, including design models, redesign processes, and guiding principles. Case studies, current redesign projects and field studies. 4 lectures. Prerequisite: BUS 382 or consent of instructor.

BUS 479 Purchasing and Materials Management (4)
Role and scope of the procurement function and concept of an integrated materials management process. Relations with functional departments. Purchasing structure and processes in business and service organizations. Global concept of international purchasing. Measuring purchasing performance. 4 lectures. Prerequisite: ECON 222 and IT 371.

BUS 483 Seminar in Managerial Consultation (4)
Management consulting in the private and public sectors. Analysis of substantive and process skills required to provide independent and objective advice to clients. Application of consulting knowledge and skills to real client problems and facilitation of change. 4 seminars. Prerequisite: BUS 382 and BUS 387.

BUS 484 Corporate Training (4)
Developing and managing curriculum for an industrial setting. Developing a philosophy, assessing resources, developing and sequencing objectives, developing and properly using materials in training, evaluating and reporting effectiveness. Managing people and resources within this process in an industrial setting. 4 lectures. Prerequisite: Senior standing.

BUS 486 Human Resource Information Systems (4)
Application of computers to the management of human resources. Human resource decision support systems and routine transaction processing. Ethical use of information systems in managing the human resource function. Basic system design decisions. Use of information systems to support traditional human resource functional areas. Exposure to enterprise-wide, integrated software. 4 lectures. Prerequisite: BUS 384 and BUS 391.

BUS 488 Planning and Managing New Ventures (4)
The purpose and process of business planning and the challenges of managing a start-up enterprise. Preparation of a complete business plan: management and organization; product or service; marketing; finance; operating and control systems; growth. 4 seminars. Prerequisite: Senior standing. Changed effective Fall 2008; see Updates.

BUS 489 Negotiation for Managers (4)
Theory and practice of negotiation in the management of enterprises., including ethical issues in negotiation and the impact of culture on negotiation. 4 lectures. Prerequisite: BUS 387.

BUS 491 Modeling and Analysis Using Computer Simulation (4)
Modeling organizational systems and processes such as computer networks, transportation systems, manufacturing systems, retail systems, etc. Developing computer simulation models and animation of systems to provide decision support in selecting system design alternatives. Applying quantitative methods to model uncertainty and conduct statistical performance analysis. 4 lectures. Prerequisite: BUS 391, STAT 251 or equivalent.

BUS 494 Enterprise Information Systems (4)
Information systems in an integrated business environment. Collaborative learning with teams analyzing, designing, implementing and evaluating enterprise software. Determine and implement organizational policies and procedures to assure system performance. Coverage of business processes in the areas of accounting, procurement, human resource, production customer relationship and supply chain management. Ethical use of information systems in managing businesses. Role of information systems in conducting business in a socially responsible manner. 4 lectures. Prerequisite: BUS 391.

BUS 495 Software Testing (4)
Theory and practice of software testing, including state-of-the-art practices, design issues, staffing issues, test management issues, and other related areas. Software testing tools utilized for applications testing, and test management. 4 lectures. Prerequisite: BUS 391 and CPE/CSC 101 or CSC 237 (with a grade of C- or better), or consent of instructor.

BUS 496 Electronic Commerce (4)
Focus on the technology of electronic commerce, including programming, development environments and security, through a series of lectures, guest speakers, demonstrations, exercises and case studies. Networking, client/server computing, and web/database design concepts. Working ecommerce application required at end of course. 4 lectures. Prerequisite: BUS 391, CPE/CSC 101 or CSC 237 (with a grade of C- or better), BUS 390.

BUS 498 Directed Topics in Information Systems (4)
Specialized Information Systems (IS) topic selected from the IS areas of current interest. Intended for advanced IS concentration students who want to learn and acquire in-depth IS knowledge and skills. The Schedule of Classes will list topic selected. 4 lectures. Prerequisite: IS concentration students only, and consent of instructor.

BUS 499 Data Communications and Networking (4)
Combines the fundamental concepts of data communications and networking with practical applications in business. Provides a basic understanding of the technical and managerial aspects of business telecommunication. Introduction to data communications and applications and technical fundamentals, and to network products, technologies, applications, and services. 4 lectures. Prerequisite: BUS 391, or consent of instructor.

BUS 501 Managerial Accounting and Managerial Economics I (5)
Accounting portion of course covers applications of accounting to management decision-making, planning, and control. Cost behavior analysis, budgets, performance reporting, plus motivational and behavioral considerations. Economics portion of course covers demand and supply analysis, static and dynamic market equilibrium analysis, and elasticities. 5 lectures. Prerequisite: Graduate standing.

BUS 502 Managerial Finance and Managerial Economics II (4)
Finance portion of course covers short-term financial management, investment decisions, and cost of capital determination. Economics portion of course covers consumer choice analysis, theory of the firm, production theory, and market structures. 4 lectures. Prerequisite: BUS 501.

CD–CHILD DEVELOPMENT

CD 102 Orientation to the Child Development Major (1)
Introduction to the child development major, self-assessments, career opportunities, university and community resources, and the program at Cal Poly. 1 lecture. Prerequisite: CD majors only or consent of instructor.

CD 109 Parenting (2)
Philosophies and techniques explored out of which an individual can devise an effective parenting style. Basic skills for parent effectiveness. 2 lectures.

CD 130 Supervised Study of Children (4)
Faculty supervised experience with young children. Participant observation, data collection skills, planning and conducting activities for individuals and groups in educational or childcare facilities.

CD 200 Special Problems for Undergraduates (1–4)
Supervised investigation, including a written report, of a topic chosen with prior approval of instructor. Total credit limited to 6 units, with a maximum of 4 units per quarter.

CD 207 The Learner’s Development, Culture and Identity in Educational Settings (4) (Also listed as EDUC 207)
Theoretical background of child and early adolescent development within diverse cultural settings and implications for the teaching-learning process. Observations of children in everyday settings. 3 lectures, 1 activity. Prerequisite: PSY 201 or PSY 202.

CD 208 Infant and Toddler Development (4)
Human development from conception through the second year of life. Examination of theory and research in multiple domains of development. Consideration of environments and activities which enhance the emerging capabilities of infants and toddlers. 4 lectures.
CD 209 Early Childhood Development (4)
Human development from conception through early childhood. Discussion and analysis of research and theory regarding physiological, cognitive and psychosocial domains of development, especially as they apply to working with young children and families in educational settings. 4 lectures. Prerequisite: PSY 201 or PSY 202, or consent of instructor.

CD 210 Middle Childhood (4)
Examination of research and theory regarding physical, cognitive, and psychosocial development in middle and late childhood, and the implications for work with youth in educational settings. 4 lectures. Prerequisite: CD 209.

CD 254 Family Psychology (4) (Also listed as PSY 254)
Introduction to research and theory on family relationships and behavior across the lifespan. Contextual influences, diversity of family forms, and topics such as love, mate selection, marital quality, parenting, gender, household work, divorce, and remarriage. 4 lectures. Prerequisite: PSY 201 or PSY 202.

CD 306 Adolescence (4) (Also listed as PSY 306)
Psychological analysis of the years from prepubescence to young adulthood. Current research on behavior and development during adolescence with emphasis on physical, affective, cognitive, sociocultural, historical, family, peer and school aspects of life during the post-child, pre-adult years. 4 lectures. Prerequisite: PSY 201 or PSY 202, junior standing.

CD 308 Preschool Laboratory: Applications of Learning, Development and Technology (4) (formerly CD 312)
Teaching experience with children in a preschool laboratory setting. Participant planning, execution and evaluation of age-appropriate activities. Observation is used as the basis for planning for the development of the whole child. A special multimedia project completed in conjunction with CD 309, CD 310 or CD 311. 4 laboratories. Prerequisite: CD 209, or consent of instructor. Co-requisite: CD 309, CD 310 or CD 311.

CD 309 Learning, Development, and Technology I (4)
Introduction to relationship between development and learning, and to application of developmental principles to the creation of age appropriate curriculum. Principles illustrated through examination of sensory-motor development and appropriate activities for promoting gross motor, fine motor, perceptual, and volitional development. 4 activities. Prerequisite: CD 209, computer literacy (Recommended: CSC 232, CSC 113 or CSC 118).

CD 310 Learning, Development, and Technology II (4)
Examination of developmental learning and the activities, organizational practices, and methods which promote or hinder it, with a special examination of the influence of development in the process of children learning to read. 4 activities. Prerequisite: CD 309.

CD 311 Learning, Development, and Technology III (4)
Examination of the concept of learning competence and its relation to creativity. 4 activities. Prerequisite: CD 310.

CD 324 Guiding Children (4)
Group process and guidance techniques for adults working with children in family, community, and educational settings. Examination of cases which require the application of theory to practical situations typically encountered by adults working with children. 4 lectures. Prerequisite: CD 130, CD 209, or consent of instructor.

CD 329 Research Methods in Child Development (4)
Introduction to research methods in child development. Critically evaluating research literature, generating research questions, and conducting observations and interviews with children and adolescents. 3 lectures, 1 activity. Prerequisite: CD 209 or PSY 256 or CD/EDUC 207, STAT 217.

CD 330 Supervised Internship (4) (CR/NC)
Faculty-supervised internship. Role of professional apprentice is experienced and analyzed by each student. Credit/No Credit grading only. Prerequisite: CD major, CD 308, CD 309, CD 324, PSY 323, KINE 280 or equivalent first aid certification, junior standing and consent of instructor.

CD 350 Developmental Issues in Education (4)
Current issues concerning how human beings develop and learn. Topics may include motivation, intelligence, peer relations, creativity, learning competence, moral development, and the implications these topics have for education. 4 lectures. Prerequisite: CD 209 or PSY 256 or CD/EDUC 207.

CD 390 Career Planning (2) (CR/NC) (Also listed as PSY 390)
Individual career and graduate school planning. Current employment issues for college graduates such as career profiles, trends and work environments. Credit/No Credit grading only. 2 seminars. Prerequisite: Junior standing or consent of instructor.

CD 400 Special Problems for Advanced Undergraduates (1–4)
Supervised investigation, including a written report, of a topic chosen with prior approval of instructor. Total credit limited to 6 units, with a maximum of 4 units per quarter. Prerequisite: Junior standing.

CD 401 Perspectives on Childhood Education (4)
Past, present and future perspectives in theory and practice of childhood education. Analysis of current research issues and applications. 4 seminars. Prerequisite: CD 310, CD 329, CD 330 or consent of instructor.

CD 404 Administration of Children's Programs (4)
Organization and administration of programs for young children, preschool and child care centers. Staffing, finance, equipment, records, program evaluations, regulations, public policy and community relations. 4 lectures. Prerequisite: CD 209.

CD 430 Advanced Internship (4) (CR/NC)
Faculty-supervised preprofessional experience in a career-related setting which complements the CD 330 internship. Such roles as master teacher, caseworker, therapeutic intern, administrative aide or program specialist are experienced and analyzed by each student. Credit/No Credit grading only. Prerequisite: CD major, CD 330, and consent of instructor.

CD 461 Senior Project Seminar (2)
Senior project expectations and skills. Students work alone or in groups to identify appropriate topics, methods and content for the senior project; to be presented in a series of progress reports. 2 seminars. Prerequisite: CD major, completion of GWR, CD 309, CD 329, and consent of instructor.

CD 462 Senior Project (2)
Completion of a project under faculty supervision. Prerequisite: CD 461.

CD 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1–4 lectures. Prerequisite: Consent of instructor.

CE–CIVIL ENGINEERING

CE 111 Introduction to Civil Engineering (1) (CR/NC)
Broad overview of the field of civil engineering, including professional societies and their student chapters, professional licensing and registration, professional codes of ethics, the elements of engineering design, and the scope of analysis and design activities undertaken by private- and public-sector civil design professionals. Credit/No Credit grading only. 1 lecture.

CE 114 Introduction to CAD in Civil and Environmental Engineering (4)
The Civil and Environmental Engineering design process. Use of AutoCAD to illustrate and quantify design alternatives. Practice in creating and evaluating typical designs drawn from different specialty areas of the field. Related topics in information technology. 2 lectures, 2 laboratories. Prerequisite: MATH 141; CSC 110 or equivalent or passing score on qualifying test of basic computer skills.

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CE 200 Special Problems for Undergraduates (1–2) (CR/NC)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Credit/No Credit grading only. Prerequisite: Consent of department chair.

CE 201 Mechanics of Materials (6)
Stresses, strains, and deformations associated with torsion, axial, shear, moment, and pressure vessel loadings. Combined loadings and principle representations of the states of stress and strain at a point. Basic failure criteria. Introduction to stability including buckling of columns. Equiv-alent in content to CE 204 and CE 207. 6 lectures. Prerequisite: ME 211.

CE 204 Mechanics of Materials I (3)
Stresses, strains, and deformations associated with axial, torsional, and flexural loading of bars, shafts, and beams. Analysis of elementary indeterminate and indeterminate mechanical and structural systems. 3 lectures. Prerequisite: ME 211.

CE 206 Strength of Materials Laboratory (1)
Introduction to experimental stress analysis. Verification of analytical equations through strain gage measurements of axially, torsionally, and flexurally loaded specimens. 1 laboratory. Prerequisite or concurrent: CE 201 or equivalent (CE 205 from prior catalogs).

CE 207 Mechanics of Materials II (3)
Combined stress states including torsion, axial, shear, moment, and pressure vessel loadings. Principle stress/strain states. Basic failure criteria. Analysis of beam forces, moments, deflections, and rotations. Introduction to stability concepts including column buckling. 3 lectures. Prerequisite: CE 204.

CE 221 Fundamentals of Transportation Engineering (3)
The characteristics and functions of highway, air, rail, transit and other modes of urban and intercity transportation. Fundamentals of transportation design, operations, and planning. Evaluation of costs, benefits, and environmental considerations. 3 lectures. Prerequisite: MATH 141.

CE 222 Fundamentals of Transportation Engineering Laboratory (2)
Application of principles of transportation planning, operations, and design. Emphasis on urban transportation planning and operations, and the design of urban and intercity highway and rail facilities. Experimental determination of the physical and mechanical properties of pavement materials through laboratory and field testing. Analysis of data and preparation of testing reports. 2 laboratories. Prerequisite or concurrent: CE 221.

CE 240 Additional Engineering Laboratory (1-2) (CR/NC)
Special assignments undertaken by students who need or wish to acquire abilities supplementary to their standard pattern of courses. Assignments must be primarily of shop or laboratory nature. Work done with minimum faculty supervision. Total credit limited to 6 units. Credit/No Credit grading only. 1-2 laboratories.

CE 251 Numerical Methods in Engineering (4)
Concepts from numerical analysis and basic programming theory introduced in the context of engineering applications. Topics include the application of programming constructs, finite precision calculations, vectors, matrices, eigenvalues/vectors, linear systems, linear programming, basic nonlinear systems, differential equations, plotting, statistics, least squares, and approximations. 3 lectures, 1 laboratory. Prerequisite: CE 114 and MATH 244.

CE 259 Civil Engineering Materials (2)
Experimental determination of mechanical properties of concrete, asphalt, and soils as required for engineering applications. Experimental verification of assumptions made in mechanics of materials procedures. Use of strain measuring devices. Preparation of technical reports. 2 laboratories. Prerequisite: CE 204.

CE 336 Water Resources Engineering (4)
Hydraulics of pile flow. Open channel flow, groundwater, and hydrology. 4 lectures. Prerequisite: ME 341.

CE 337 Hydraulics Laboratory (1)
Application of basic fluid dynamic principles to various mechanical systems. Exposure to experimental problems and techniques with guided laboratory projects related to civil engineering discipline. 1 laboratory. Prerequisite: ME 341.

CE 351 Structural Analysis (4)
Analysis for member forces and deflections of determinate and indeterminate structures, including trusses, beams, and frames. General theorems, influence diagrams, and energy methods. 3 lectures, 1 laboratory. Prerequisite: CE 251 and either CE 201 or CE 207.

CE 355 Reinforced Concrete Design (4)
Analytical and design principles of reinforced concrete in designing civil engineering systems. Origin of code requirements. Fundamentals of proportioning. Details of elements and structural systems. 3 lectures, 1 laboratory. Prerequisite: CE 259, CE 351.

CE 356 Structural Steel Design (4)
Design and behavior of the elements of steel structures. Design and analysis of bolted, welded and eccentric connections. Proportioning of members and connections. Introduction to plastic design, end plate connection, composite construction, shear connections and design of composite beams. 3 lectures, 1 laboratory. Prerequisite: CE 351.

CE 381 Geotechnical Engineering (4)
Engineering geology, elementary mass-volume relations, clay-water interaction, soil classification, soil compaction, geostatic stress distributions, 1-D and 2-D steady-state flow, shear strength under drained and undrained conditions. 4 lectures. Prerequisite: CE 207 and ME 341. Concurrent: CE 382 (CE majors only).

CE 382 Geotechnical Engineering Laboratory (1)
Use of standard laboratory test methods to determine physical, mechanical, and hydraulic properties of soil. 1 laboratory. Co-requisite: CE 381.

CE 400 Special Problems for Advanced Undergraduates (1–2)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of department chair.

CE 401 Linear Elasticity (4)

CE 402 Advanced Strength of Materials (4)
Development of reduced order theories such as torsion, beams and columns from the general three-dimensional continuum. Application and limitation of these theories are discussed. Similarities are drawn between analytical formulas and code base rules and/or formulas. 4 lectures. Prerequisite: CE 351.

CE 405 Concrete Materials (4)
Supplementary cementitious materials and chemical admixtures and their incorporation into concrete mix design. Design and testing of concrete for durability and other specialized properties. 3 lectures, 1 laboratory. Prerequisite: CE 259.

CE 407 Structural Dynamics (4)
Effect of vibration and transient loads on structural elements. Dynamics load factors, support motion, damping and natural frequencies of multidimensional structural systems. Modal analysis. 3 lectures, 1 laboratory. Prerequisite: CE 351, ME 212.

CE 421 Traffic Engineering (4)
Principles of traffic circulation on highway systems and other modes. Traffic control. Traffic data collection and analysis. Capacity analysis. Traffic modeling. New technologies. 3 lectures, 1 laboratory. Prerequisite: CE 221 or consent of instructor.
CE 422 Highway Geometrics and Design (4)
Alignment location and safe geometric design of highways. Earthwork and drainage related to highway. Theory and practice in design of alignments, highway cross-sections, intersections, interchanges, and freeways in urban and rural areas. Application of advanced computer software to highway geometries. 2 lectures, 2 laboratories. Prerequisite: CE 221 or consent of instructor.

CE 423 Intelligent Transportation Systems (4)
Specification and operation of Intelligent Transportation Systems (ITS). Traffic surveillance and control systems including applications to freeways, urban streets, rural highways, and public transportation. Standards include the National Architecture for ITS. 3 lectures, 1 laboratory. Prerequisite: CE 221, graduate standing, or consent of instructor.

CE 424 Public Transportation (4)
Interdisciplinary aspects of public transportation problems, systems-team design approach to solutions. History and present state of public transportation; role of public transportation in urban environment; legislative, political, social, and economic aspects of public transportation systems. Methodology and procedures for transit planning. Review of transit studies. 3 lectures, 1 laboratory. Prerequisite: CE 221 or consent of instructor.

CE 431 Coastal Hydraulics I (3)
Waves and their characteristics, types of waves, wave water theories, orbital velocities, refraction of waves, wave diffraction, wave reflection, application of linear theory to wave forces on cylindrical structures, submerged pipelines and vertical flat barriers (sea walls), wave uprush, rubble mound breakwaters. 3 lectures. Prerequisite: ME 341.

CE 432 Coastal Hydraulics II (3)
Reformed breaker height determination, wave runup analysis using a reformed breaker height. Wave setback analysis. Pile height determination. Criteria for types of breaking waves. Runvetement analysis, rip-rap revetment design, wave forces on piling. 3 lectures. Prerequisite: CE 431.

CE 434 Groundwater Hydraulics and Hydrology (3)

CE 440 Hydraulic Systems Engineering (4)

CE 452 Analysis and Seismic Design of Reinforced Concrete (4)
Emphasis placed on reinforced concrete behavior and seismic design. Topics include moment curvature analysis and plastic hinge modeling, strut and tie, design of structural walls, design of concrete moment frames and seismic detailing. 4 lectures. Prerequisite: CE 454; Recommended: concurrent: CE 557.

CE 454 Structural Design (4)
Design of reinforced concrete, steel and timber structures. Loading standards, code design methods, connection design. Comprehensive design projects. 2 lectures, 2 laboratories. Prerequisite: CE 351, CE 355, CE 356.

CE 455 Design of Timber Structures (4)
Analysis and design of temporary structures with emphasis on timber structures, construction methodology, and material behavior. Topics include: physical and mechanical properties of structural lumber, lateral load paths; diaphragms; formwork design; connections; structural stability; and combined load design. 3 lectures, 1 laboratory. Prerequisite: CE 355 or CE 453.

CE 456 Seismic Principles for Civil and Environmental Engineers (4)
Basic principles in seismic analysis and design of civil and environmental systems. Seismological aspects of earthquakes. Simple concepts in structural dynamics. Simplified code-based analysis and design. 4 lectures. Prerequisite: CE 207. Not open to students with credit in CE 557.

CE 457 Bridge Engineering (4)

CE 458 Fiber Reinforced Polymer (FRP) Design (4)
Properties and mechanical characteristics of Fiber Reinforced Polymer (FRP) composite materials; applications in civil engineering structures as primary or secondary reinforcement; and design techniques based on newly developed ACI 440 design guidelines and worldwide experience in FRP design. 3 lectures, 1 laboratory. Prerequisite: CE 351 and CE 355. Concurrent: CE 356.

CE 459 FRP Strengthening of Reinforced Concrete Structures (4)
Flexural and shear strengthening reinforced and prestressed concrete members using fiber reinforced polymer composite plates and laminates; seismic repair and rehabilitation of columns, slabs, beams and structures. Focus on design philosophy and design methodology, based on the current understanding of FRP-strengthening techniques. 3 lectures, 1 laboratory. Prerequisite: CE 355.

CE 461, 462 Senior Project I, II (2) (2)
Completion of a 120-hour integrated civil research, analysis, and/or design project that is representative of those encountered in professional practice. Prerequisite: Senior standing and consent of the supervising faculty member.

CE 464 Professional Practice (3)
Examination of the non-technical issues that are dealt with on a regular basis by the design professional, including professional ethics, marketing and business development, professional engagement, personnel and project management, risk management, professional liability insurance, and dispute resolution. 3 seminars. Prerequisite: Senior standing.

CE 466 Senior Design I (3)
Work on multi-disciplinary teams to complete an integrated civil design project. Focus of formal instruction on selected topics in geotechnical, structural, transportation, and water resources engineering design. Topics, related to interpersonal communication, teamwork, leadership, ethics, and professional practice, addressed to promote understanding of the non-technical issues and skills that must be mastered to become a successful design professional. 2 lectures, 1 laboratory. Prerequisite: CE 221, CE 222, CE 336, CE 337, CE 355, CE 356, CE 381, CE 382, senior standing, and consent of instructor.

CE 467 Senior Design II (3)
Continuation of CE 466. Continuation of work on multi-disciplinary teams to complete an integrated civil design project. Focus of formal instruction on technical and non-technical issues. Summarization of team project results in formal written reports and oral presentations. 2 lectures, 1 laboratory. Prerequisite: CE 466.

CE 468, 469 Community Engineering Senior Design I, II (3) (3)
Two-part series. Student teams work in cooperation with a local community organization to complete an integrated civil design project. Focus of formal instruction on technical and non-technical issues. Two-part series representative of those encountered in professional practice. Focus on professional as well as design issues. Volunteer service required. 2 lectures, 1 laboratory. Prerequisite: CE 221, CE 222, CE 336, CE 337, CE 355, CE 356, CE 381, CE 382, senior standing, and consent of instructor.

CE 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Consent of instructor.

CE 471 Selected Advanced Laboratory (1–4)
Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories. Prerequisite: Consent of instructor.
CE 481 Analysis and Design of Shallow Foundations (4)

CE 482 Conventional Subsurface Exploration (4)
Subsurface exploration and sampling techniques. Laboratory analysis of material variability. Preparation of subsurface exploration reports. 2 lectures, 2 laboratories. Prerequisite: CE 481.

CE 486 Introduction to Geological Engineering (4)
Identification and characterization of consolidated geologic materials for the purpose of civil analysis and design. Interpretation of geologic maps, cross sections, and reports. Interpretation of aerial photographs. Engineering considerations important in dealing with transported soils. 4 lectures. Prerequisite: CE 381, CE 382, and GEOL 201.

CE 487 Design of Foundations and Slopes in Rock (4)

CE 488 Engineering Risk Analysis (4)
Introduction to the basic concepts of probability theory, statistics, and decision theory as they pertain to problems in civil and environmental engineering. Emphasis placed on the use of probabilistic modeling, Bayesian statistics, risk analysis, and decision theory. 4 lectures. Prerequisite: CE 381 and STAT 312.

CE 493 Cooperative Education Experience (2) (CR/NC)
Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. Total credit limited to 6 units. Prerequisite: Sophomore standing and consent of instructor.

CE 494 Cooperative Education Experience (6) (CR/NC)
Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. Total credit limited to 18 units. Prerequisite: Sophomore standing and consent of instructor.

CE 495 Cooperative Education Experience (12) (CR/NC)
Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. Total credit limited to 24 units. Prerequisite: Sophomore standing and consent of instructor.

CE 500 Individual Study (1–3)
Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Prerequisite: Consent of department chair, graduate advisor and supervising faculty member.

CE 501 Advanced Matrix Analysis of Structures I (4)
Matrix terminology and operations. Matrix procedures for analysis of two-dimensional frameworks. Development of stiffness, flexibility and mixed methods. Development of algorithms and programs for use in the analysis of structural frameworks. Discussion of modeling issues and limitations. 3 lectures, 1 laboratory. Prerequisite: CE 351 or consent of instructor.

CE 502 Advanced Matrix Analysis of Structures II (4)
Matrix procedures for analysis of three-dimensional frameworks. Development of algorithms and programs for use in the analysis of structural frameworks. Additional topics to include: member releases, nonprismatic members, elastic supports, offset connections and oblique supports. 3 lectures, 1 laboratory. Prerequisite: CE 501 or consent of instructor.

CE 504 Advanced Finite Element Analysis I (4)

CE 505 Advanced Finite Element Analysis II (4)
Finite element theory and analysis for multi-dimensional equations. Variational formulations and their significance. Isoparametric formulation and numerical integration. Development of two and three-dimensional finite element algorithms using industry based software. Discussion modeling issues and limitations. 3 lectures, 1 laboratory. Prerequisite: CE 504.

CE 521 Airfield and Highway Pavement Designs (4)
Theories, principles, and procedures in the structural design of highway and airfield pavements. Design of flexible and rigid pavements. Perform-ance of flexible and rigid pavements in the field and the characterization of pavement materials. Practical and direct exposure to laboratory testing of pavement materials. 3 lectures, 1 laboratory. Prerequisite: CE 221, CE 259, CE 381, graduate standing or consent of instructor.

CE 522 Advanced Transportation Design (4)
Application of computers to advanced highway and transportation systems and geometrics. Use of computers for the solution of transportation facility design problems. 2 lectures, 2 laboratories. Prerequisite: CE 221, graduate standing, or consent of instructor.

CE 523 Transportation Systems Planning (4)
Planning of urban and regional multimodal transportation systems. Modeling of transportation networks and travel demand. Travel survey design. Urban data systems. Evaluation of alternatives based on economic, social, technological, and other factors. 2 lectures, 2 laboratories. Prerequisite: CE 221, graduate standing, or consent of instructor.

CE 524 Pavement Performance and Management Systems (4)
Introduction to pavement management; pavement distress data collection; deflection measurements and analyses; pavement performance modeling; pavement structure design; maintenance planning and rehabilitation strategies; prioritization and optimization; computer applications in pavement management. 2 lectures, 2 laboratories. Prerequisite: CE 221, CE 222, CE 259.

CE 525 Airport Planning and Design (4)
Historical background of aviation and airport development; financing; estimating demand; aircraft characteristics; airport capacity; airspace and air traffic control; site selection; airport configuration; geometric design of landing area; planning and development of terminal areas; lighting; pavement design and drainage. 3 lectures, 1 laboratory. Prerequisite: CE 221, graduate standing, or consent of instructor.

CE 527 Sustainable Mobility (4)
Presentation and analysis of concepts and designs for sustainable mobility from a global-to-local, interdisciplinary perspective, including pedestrians, bicyclists, and public transportation. Addresses economy, environment, and equity (social issues) through lectures, panels, excursions and a planning/design project in San Luis Obispo County. 3 lectures, 1 laboratory. Prerequisite: Graduate standing or consent of instructor.

CE 528 Transportation Analysis (4)
Principles of engineering systems analysis and applications to transportation using examples from different modes. Identification of transportation benefits, costs, user and non-user impacts, transportation cost models, pricing, and optimization. 3 lectures, 1 laboratory. Prerequisite: CE 221, graduate standing, or consent of instructor.

CE 529 Modeling and Simulation in Transportation (4)
Theory and operation of transportation systems, the systems approach, simulation techniques. Use of available software packages. Simulation techniques.
model development, calibration and use. 2 lectures, 2 laboratories. Prerequisite: CE 221, graduate standing, or consent of instructor.

CE 533 Advanced Water Resources Engineering (3)
Matrix and simulation methods in hydrology, statistical studies in hydrology and their applications to civil engineering problems. Generalized hydrologic characteristics. Hydrologic simulation, computer applications, urban and small watershed hydrology, macroscopic and microscopic approach. Storm water management models. Hydrologic design. 3 lectures. Prerequisite: CE 336 or graduate standing.

CE 535 Water Resources Systems Planning and Analysis (3)
Water resources planning, development, system analysis and optimization. Dynamic programming, multi-objective water resource systems. 3 lectures. Prerequisite: CE 336.

CE 536 Computer Applications in Water Resources with Geographic Information Systems (GIS) (4)
Modeling, design and analysis of water, wastewater, stormwater systems. Integration of water resource systems with Geographic Information Systems (GIS). 3 lectures, 1 laboratory. Prerequisite: CE 336 and CE 440.

CE 537 Groundwater Contamination (3)
Sources and types of groundwater contamination, contamination transport mechanisms. Sorption and other chemical reactions. Numerical modeling of contaminant transport. Nonequilibrium phase liquids. Groundwater remediation and design. 3 lectures. Prerequisite: CE 114; co-requisite: CE 434 or equivalent.

CE 555 Advanced Civil Engineering Materials Laboratory (2)
Fundamental properties of new and advanced materials. Experimental techniques. Fracture characteristics and composite response of cement matrix composites. New materials and products to advanced applications such as automation. 2 laboratories. Prerequisite: CE 259 or graduate standing.

CE 557 Seismic Analysis and Design for Civil Engineers (4)
Extension of the basic principles of structural dynamics to analysis of civil structures (buildings, bridges, tanks, etc.) to earthquake loading. Code based (Uniform Building Code and AASHTO) earthquake resistant design of civil structures. 3 lectures, 1 laboratory. Prerequisite: CE 407.

CE 559 Prestressed Concrete Design (4)
Advanced analysis, design and behavior of prestressed and precast concrete elements and structures. Origin of code requirements. Detailed design of prestressed concrete components of civil engineering systems for buildings and highway construction. Creep and shrinkage of concrete and relaxation of steel applied to prestressing losses. 4 lectures. Prerequisite: CE 355 or graduate standing.

CE 570 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1–4 seminars. Prerequisite: Graduate standing or consent of instructor.

CE 571 Selected Advanced Laboratory (1–4)
Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1–4 laboratories. Prerequisite: Graduate standing or consent of instructor.

CE 573 Public Works Administration (3)
Management and engineering of infrastructure and related systems in public jurisdictions. Utility systems, streets and highways, illumination, distribution systems, etc. Personnel management, financing, public relations, and contract management. 3 seminars. Prerequisite: Graduate standing or consent of instructor.

CE 574 Computer Applications in Civil Engineering (3)
Overview of computer application, hardware and software alternatives, use of selected application programs, CAD, microcomputers, management and application of resources. 1 lecture, 2 laboratories. Prerequisite: Graduate standing or consent of instructor.

CE 581 Advanced Geotechnical Engineering (4)
Advanced topics in saturated flow, unsaturated flow, and consolidation. Stress-strain-deformation response of soils under both drained and undrained loading. Conventional and advanced laboratory strength testing. 3 lectures, 1 laboratory. Prerequisite: CE 481 or graduate standing.

CE 582 Geotechnical In Situ Testing (4)
Standard penetration, cone penetration, and flat-plate dilatometer testing. Equipment operation and maintenance. Interpretation of SPT/CPT/DMT sounding data. Stratigraphic analysis. CPT/DMT-based analysis and design of shallow and deep foundations. 2 lectures, 2 laboratories. Prerequisite: CE 481 or graduate standing.

CE 583 Geotechnical Earthquake Engineering (4)

CE 584 Lateral Support Systems (4)
Classical and modern earth pressure theories. Lateral earth pressure calculations for general subsurface conditions. Analysis and design of reinforced concrete cantilever walls, sheet pile walls, soldier-pile walls, tieback walls, and mechanically-stabilized earth. Computer-aided analysis and design. 4 lectures. Prerequisite: CE 481 or graduate standing.

CE 585 Slope Stability Analysis (4)

CE 586 Analysis and Design of Deep Foundations (4)
Bearing capacity and settlement analysis of drilled shafts and driven piles. Analysis and design of single piles and pile groups for vertical, lateral, and combined loading. Construction procedures, field inspection, and load-testing. Computer-aided analysis and design. 4 lectures. Prerequisite: CE 481 or graduate standing.

CE 588 Ground Improvement (4)
Ground improvement applications investigated for modification of geomechanical and hydraulic properties of soils. Engineering properties of soft ground and high water content materials; mechanical, chemical, and thermal stabilization investigated for foundation and environmental remediation applications. 4 lectures. Prerequisite: CE 381, CE 382, and CE 481.

CE 589 Geosynthetics Engineering (4)
Geosynthetics applications within civil engineering. Design content for geotechnical, geoenvironmental, and transportation applications. Manufacturing processes, material properties, interaction with soils, and service conditions. 4 lectures. Prerequisite: CE 481.

CE 591 Graduate Seminar I (1)
Current research activities and analysis/design philosophies in civil and environmental engineering practice. 1 seminar. Prerequisite: Graduate standing.

CE 592 Graduate Seminar II (1)
Current research activities and analysis/design philosophies in civil and environmental engineering practice. Development of oral and written presentation skills. 1 seminar. Prerequisite: CE 591 and graduate standing.

CE 593 Cooperative Education Experience (2) (CR/NC)
Advanced study analysis and part-time work experience in student’s career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.
CE 594 Cooperative Education Experience (6) (CR/NC)
Advanced study analysis and full-time work experience in student’s career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

CE 595 Cooperative Education Experience (12) (CR/NC)
Advanced study analysis and full-time work experience in student’s career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

CE 599 Design Project (Thesis) (1-9)
Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis. Prerequisite: Graduate standing.

CHEM—CHEMISTRY

CHEM 101 New course – Effective Fall 2008; see Updates

CHEM 106 Introductory Chemistry (3)
Introductory course in chemistry. Measurement, metric system, properties of matter, chemical symbols, atomic structure, chemical formulas, nomenclature, chemical equations, the mole concept, stoichiometry. Not open to students who have credit in a college chemistry course. 3 lectures.

CHEM 110 World of Chemistry (4) GE B3 & B4
The fundamentals of chemical cause and effect—structure/function relationships. The basic principles of chemistry and their applications to solving human problems in organic materials science, biochemistry, toxicology, environmental science, agriculture, nutrition, and medicine. Not open to students majoring in Chemistry or Biochemistry. 3 lectures, 1 laboratory. Prerequisite: Passing score on the ELM examination for MATH 116 eligibility, or an ELM exemption, or MATH 104.

CHEM 111 Survey of Chemistry (5) GE B3 & B4
Introduction to atomic theory, chemical reactions, bonding, stoichiometry, nomenclature, and solutions. Intended for students who are preparing for CHEM 212/312. Not open to students with credit for CHEM 127. 4 lectures, 1 laboratory. Prerequisite: High school chemistry or CHEM 106 or equivalent, and passing score on the ELM examination for MATH 116 eligibility, or an ELM exemption, or MATH 104.

CHEM 124 General Chemistry for the Engineering Disciplines I (4) GE B3 & B4
General chemistry concepts presented using a materials science approach with engineering applications. Thermochemistry, bonding, solid-state structures, fundamentals of organic chemistry including polymers. Classwork is presented in an integrated lecture-laboratory format, with an emphasis on computer-based data acquisition, collaborative methods and multimedia-based presentation. Equivalent to 3 lectures, 1 laboratory. Prerequisite: High school chemistry or CHEM 106 or equivalent, and passing score on the ELM examination for MATH 116 eligibility or an ELM exemption or MATH 104.

CHEM 125 General Chemistry for the Engineering Disciplines II (4) GE B3 & B4
A continuation of general chemistry designed for engineering students. Topics include solution chemistry, thermodynamics, kinetics, equilibrium, acids and bases, electrochemistry, and nuclear chemistry. Integration of laboratory with theoretical concepts. Use of computers for data acquisition and multimedia resources. Guided inquiry and collaborative methods emphasized. 3 lectures, 1 laboratory. Prerequisite: CHEM 124 or consent of course coordinator.

CHEM 127 General Chemistry I (4) GE B3 & B4
Introduction to atomic theory, chemical reactions, bonding, stoichiometry, nomenclature, gas laws, colligative properties, colloids and solutions. Intended primarily for students whose majors are in the College of Science and Mathematics. 3 lectures, 1 laboratory. Prerequisite: High school chemistry or CHEM 106 or equivalent, and passing score on the ELM examination for MATH 116 eligibility or an ELM exemption or MATH 104.

CHEM 128 General Chemistry II (4)
Continuation of CHEM 127. Oxidation-reduction reactions, electrochemistry, kinetics, equilibria, thermodynamics, acids and bases. Intended primarily for students whose majors are in the College of Science and Mathematics. 3 lectures, 1 laboratory. Prerequisite: CHEM 127.

CHEM 129 General Chemistry III (4)
Acid and base equilibria, buffers, transition elements, solubility, complex ions, hybridization, nuclear chemistry. Laboratory study of the chemical properties and semi-micro qualitative analysis of the representative group elements of the periodic table. 3 lectures, 1 laboratory. Prerequisite: CHEM 125 or CHEM 128.

CHEM 200 Special Problems for Undergraduates (1–2)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: CHEM 111, CHEM 124, or CHEM 127 and consent of department chair.

CHEM 201 Undergraduate Research (1-3) (CR/NC)
Laboratory research under faculty supervision. Credit/No Credit grading only. Total credit limited to 6 units. 1-3 laboratories. Prerequisite: Consent of instructor.

CHEM 212 Introduction to Organic Chemistry I (5)
Introduction to the fundamentals of organic chemistry nomenclature and selected reactions for the major functional groups. Promotes an understanding of how the structure and reactions of selected organic molecules relate to living systems and our environment. CHEM 212 accepted in lieu of CHEM 312, but not for upper division credit. Not open to students with credit in CHEM 312. CHEM 212/312, 4 lectures, 1 laboratory. Prerequisite: CHEM 111 or CHEM 128 or equivalent.

CHEM 216 Introduction to Organic Chemistry I (5)
Basic principles of the bonding, isomerism and stereochemistry in compounds of carbon. Essentials of organic nomenclature. Representative reactions and mechanisms for selected aliphatic and aromatic compounds. Introduction to the physical analysis and synthesis of organic compounds. CHEM 216 accepted in lieu of CHEM 316, but not for upper division credit. Not open to students with credit in CHEM 316. 4 lectures, 1 laboratory. Prerequisite: CHEM 111 or CHEM 125 or CHEM 128.

CHEM 217 Introduction to Organic Chemistry II (5)
Properties and reactions of carbonyl compounds, alcohols, and organic halides with an overview of the mechanisms of the reactions. Introductory concepts and applications of infrared and NMR spectroscopy. CHEM 217 accepted in lieu of CHEM 317, but not for upper division credit. Not open to students with credit in CHEM 317. 3 lectures, 2 laboratories. Prerequisite: CHEM 216/316.

CHEM 218 Introduction to Organic Chemistry III (3)
Properties and reactions of amines, heterocyclic and aromatic compounds with an overview of the mechanisms of the reactions. Introductory concepts and applications of ultraviolet spectroscopy and mass spectrometry. CHEM 218 accepted in lieu of CHEM 318, but not for upper division credit. Not open to students with credit in CHEM 318. 3 lectures. Prerequisite: CHEM 217/317.

CHEM 222 New course – Effective Winter 2009; see Updates.

CHEM 231 Introduction to Quantitative Analysis (5)
Fundamental theory for common titrimetric and spectrophotometric methods in analytical chemistry. Essentials of chemical equilibria as it applies to titration curves. The laboratory focuses on precision and accuracy of common, practical methods in analytical chemistry. CHEM 231 accepted in lieu of CHEM 331, but not for upper division credit. Not open to students with credit in CHEM 331. 3 lectures, 2 laboratories. Prerequisite: CHEM 129.

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CHEM 252 Laboratory Glassblowing (1)
Techniques of glassblowing applied to the making of simple laboratory apparatus. 1 laboratory. Prerequisite: CHEM 111, CHEM 124 or CHEM 127.

CHEM 305 Physical Chemistry for Engineers (4) GE B6
Fundamentals and applications of chemical thermodynamics of particular interest to engineers. Chemical and phase equilibria. 4 lectures. Prerequisite: PHYS 123 or PHYS 133, CHEM 125 or CHEM 129, MATH 143.

CHEM 312 Survey of Organic Chemistry (5)
Structure, isomerism, nomenclature, fundamental reactions of major functional groups and applications of organic chemicals in agriculture, medicine, industry, and the home. Not open to students with credit in CHEM 212 or CHEM 216/316. 4 lectures, 1 laboratory. Prerequisite: CHEM 111 or CHEM 127 or equivalent.

CHEM 313 Survey of Biochemistry and Biotechnology (5)
Chemistry of biomolecules including carbohydrates, proteins, fats, vitamins, enzymes and hormones. Basic molecular biology with applications to biotechnology and genetic engineering. Practical intermediary metabolism of prokaryotic and eukaryotic systems. 4 lectures, 1 laboratory. Prerequisite: CHEM 212 or CHEM 212/312 or equivalent.

CHEM 316 Organic Chemistry I (5)
Structure, bonding, nomenclature, isomerism, stereochemistry and physical properties of organic compounds. Introduction to spectroscopy. Reactions and mechanisms of alkanes, alkenes, alkynes, cycloalkanes and aromatic compounds. Laboratory techniques in organic preparations. 4 lecture, 1 laboratory. Prerequisite: CHEM 111 or CHEM 125 or CHEM 128.

CHEM 317 Organic Chemistry II (5)
Reactions and reaction mechanisms of organic halides, alcohols, phenols, epoxides, ethers, carboxylic acids and their derivatives, aldehydes, ketones; acidity and basicity; infrared and NMR spectroscopy. 3 lectures, 2 laboratories. Prerequisite: CHEM 216/316.

CHEM 318 Organic Chemistry III (3)
Chemistry of amines, aromatic compounds, heterocycles, macromolecules, some biomolecules, carbanions, rearrangement and ultraviolet and mass spectrometry. 3 lectures. Prerequisite: CHEM 217/317.

CHEM 319 Advanced Organic Chemistry Laboratory (2)
Practice in multiple step organic synthesis, column chromatography, vacuum distillation, enzymes as chemical reagents, inert atmosphere techniques, introduction to FT NMR spectroscopy and mass spectrometry, survey of organic chemical literature. 2 laboratories. Concurrent or prior enrollment in CHEM 218/318.

CHEM 331 Quantitative Analysis (5)
Theory and application of chemical equilibrium to analytical problems. Survey of important analytical methods with stress placed on the theory and application associated with titrimetric and spectrophotometric analysis. 3 lectures, 2 laboratories. Prerequisite: CHEM 129.

CHEM 341 Environmental Chemistry: Water Pollution (3)
Chemical aspects of water and water pollution: alkalinity; acid deposition, particularly relating to lake and stream acidification and forest decline; drinking water treatment and THMs; wastewater treatment; detergents, builders, and eutrophication; pesticides; other toxic organic compounds such as PCBs and dioxin; hazardous wastes; toxic elements such as Pb, Hg, Sn, Cd, and Se. 3 lectures. Prerequisite: CHEM 129 and CHEM 212/312 or CHEM 216/316.

CHEM 342 Environmental Chemistry: Air Pollution (3)
Chemical aspects of the atmosphere and air pollution: greenhouse effect and global climate change; CFCs, the ozone layer, and the ozone hole; carbon monoxide, nitrogen oxides, and photochemical smog, particulate matter; radon, asbestos, indoor air pollution; sulfur oxides and acid deposition, particularly relating to atmospheric reactions and control options. 3 lectures. Prerequisite: CHEM 129 and CHEM 212/312 or CHEM 216/316.

CHEM 349 Chemical and Biological Warfare (4) GE Area F
History, development, and use of chemical and biological warfare (CBW). Chemical and biological disarmament. Production and destruction of CBW agents. Uses of CBW. CBW terrorism. Ethics of CBW. 2 lectures, 2 seminars. Prerequisite: Completion of GE Area B, including a chemistry course (CHEM), a course in biology (BIO, MCRO or ZOO), and junior standing.

CHEM 350 Chemical Safety (1)
Laboratory regulations, equipment hazard analysis, hazardous chemicals, classification of chemicals, toxic materials handling, reaction hazards, radiation, emergency procedures, safety management programs and legal concerns. Includes project. 1 lecture. Prerequisite: CHEM 212/312 or equivalent.

CHEM 351 Physical Chemistry I (3)
Basic physical chemistry for the study of chemical and biochemical systems. Kinetic-molecular theory, gas laws, principles of thermodynamics. Not open to students with credit in CHEM 305. 3 lectures. Prerequisite: CHEM 129, PHYS 122 or PHYS 132, MATH 143.

CHEM 352 Physical Chemistry II (3)
Application of physical chemistry to chemical and biochemical systems. Electrochemistry, kinetics, viscosity, surface and transport properties. 3 lectures. Prerequisite: CHEM 305 or CHEM 351.

CHEM 353 Physical Chemistry III (3)
Principles and applications of quantum chemistry. Chemical bonding and molecular structure. Spectroscopy and diffraction. 3 lectures. Prerequisite: CHEM 352.

CHEM 354 Physical Chemistry Laboratory (2)
Experimental studies of gases, solutions, thermochemistry, chemical and phase equilibria, electrochemistry, chemical and enzyme kinetics, computational methods and applications to chemistry and biochemistry. Use of applicable literature and databases. 2 laboratories. Prerequisite: CHEM 231/331 and CHEM 352.

CHEM 357 Physical Chemistry III Laboratory (1)
Experimental and computational investigations of quantum chemistry, spectroscopy, symmetry and statistical chemistry. 1 laboratory. Corequisite: CHEM 353.

CHEM 371 Biochemical Principles (5)
Chemistry and function of major cellular constituents: proteins, lipids, carbohydrates, and membranes. 4 lectures, 1 laboratory. Prerequisite: CHEM 212/312 or CHEM 217/317. Recommended: CHEM 231/331.

CHEM 372 Metabolism (3)
Intermediary metabolism, regulation and integration of metabolic pathways, bioenergetics, photosynthesis, electron transport, nitrogen fixation, biochemical function of vitamins and minerals. 3 lectures. Prerequisite: CHEM 371. Changed effective Fall 2008; see Updates.

CHEM 373 Molecular Biology (3)

CHEM 375 Molecular Biology Laboratory (2)
(Also listed as BIO 375)
Introduction to techniques used in molecular biology and biotechnology; DNA extraction, characterization, cloning, Southern blotting, reverse transcription, polymerase chain reaction, and sequencing analysis. 2 laboratories. Prerequisite: BIO 161, and BIO 351 or CHEM 373. Changed effective Fall 2008; see Updates.

CHEM 377 Chemistry of Drugs and Poisons (3)
Introduction to pharmacology and toxicology: history, sources, development and testing, physical and chemical properties, biochemical and physiological effects, mechanisms of action, and the therapeutic uses and toxicology of common drugs and poisons. 3 lectures. Prerequisite: CHEM 313 or CHEM 371 or consent of instructor.
CHEM 385 Geochemistry (3)
Application of chemical principles to terrestrial and extraterrestrial systems. Formation of the elements; chemical influences on the earth's formation; chemical evolution studies; age-dating techniques; reactions in sea water; petroleum and ore formation; distribution and movement of the elements. 3 lectures. Prerequisite: CHEM 216/316, CHEM 231/331.

CHEM 400 Special Problems for Advanced Undergraduates (1–3)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 6 units. 1-3 laboratories. Prerequisite: Consent of instructor. 4 units may be applied to approved chemistry electives.

CHEM 401 Advanced Undergraduate Research (1–3) (CR/NC)
Laboratory research under faculty supervision. Credit/No Credit grading only. Total credit limited to 6 units. 1-3 laboratories. Prerequisite: Consent of instructor. Changed effective Summer 2008; see Updates.

CHEM 405 Advanced Physical Chemistry (3)
Selected advanced topics in physical chemistry, which may include statistical mechanics, computational chemistry, nonequilibrium thermodynamics, lasers in chemistry, solid-state and/or advanced spectroscopy. Total credit limited to 6 units. 3 lectures. Prerequisite: CHEM 353 or consent of instructor.

CHEM 419 Bioorganic Chemistry (3)
Methods of investigating reaction mechanisms, mechanisms of chemical catalysis, organic models of enzymes, chemistry of vitamins that serve as enzyme cofactors, chemistry of the phosphate group, synthesis of biomolecules. 3 lectures. Prerequisite: CHEM 218/318.

CHEM 420 Advanced Organic Chemistry–Synthesis (3)

CHEM 439 Instrumental Analysis (5)
Theory, practice and method selection of modern instrumental analytical techniques, including spectroscopic, electrochemical, chromatographic and thermal methods. Current industrial applications. Laboratory work emphasizes optimization of experimental parameters. 3 lectures, 2 laboratories. Prerequisite: CHEM 231/331, CHEM 354. Recommended: CHEM 353.

CHEM 441 Bioinformatics Applications (4) (Also listed as BIO 441) (formerly BIO 447)
Introduction to new problems in molecular biology and current computer applications for genetic database analyses. Use of software for: nucleic acid, genome and protein sequence analysis; genetic databases, database tools; industrial applications in bioinformatics; ethical and societal concerns. 3 lectures, 1 laboratory. Prerequisite: One course in college biology (BIO 111 or BIO 161 recommended). Recommended: BIO 303, BIO 351 or CHEM 373.

CHEM 443 Organic Chemistry Concepts for Materials Engineering (1) (CR/NC)
Introduction to organic chemistry of polymers and basic methods of polymer analysis. Designed for students with little or no organic chemistry background. Not open to Chemistry or Biochemistry majors. Credit/No Credit grading only. 1 activity. Prerequisite: CHEM 125 or CHEM 129; corequisite: CHEM 444.

CHEM 444 Polymers and Coatings I (3)
Physical properties of polymers and coatings and their measurement. Molecular weight averages, glass transition, thermodynamics of polymers. Viscoelastic properties, rheology, molecular weight determination. Thermal analysis, spectroscopic analysis, mechanical testing. 3 lectures. Prerequisite: CHEM 217/317 or concurrent enrollment in CHEM 443.

CHEM 445 Polymers and Coatings II (3)
Introduction to polymerization methods and mechanisms. Chemistry of initiators, catalysts and inhibitors. Uses of representative polymer types. Synthesis, film formation, structure and properties of polymers commonly used in coatings and adhesives. 3 lectures. Prerequisite: CHEM 217/317.

CHEM 446 Surface Chemistry of Materials (3) (Also listed as MATE 446)
Surface energy. Capillarity, solid and liquid interface, adsorption. Surface areas of solids. Contact angles and wetting. Friction, lubrication and adhesion. Relationship of surface to bulk properties of materials. Applications. 3 lectures. Prerequisite: CHEM 305 or CHEM 351 or course in engineering thermodynamics.

CHEM 447 Polymers and Coatings Laboratory I (2)

CHEM 448 Polymers and Coatings Laboratory II (2)
Experimental techniques of producing and characterizing coatings. Modern methods of testing protective coatings. Surface preparation techniques. 2 laboratories. Prerequisite: CHEM 444, CHEM 445.

CHEM 449 Internship in Polymers and Coatings (2)
Selected students will spend up to 12 weeks with an approved polymers and coatings firm engaged in production or related business. Time will be spent applying and developing production and technical skills and abilities in the polymers and coatings industry. Prerequisite: CHEM 217/317 or consent of instructor.

CHEM 455 FT-NMR Laboratory (1) (CR/NC)
Basic theory and operation of the high-field Fourier transform nuclear magnetic resonance spectrometer. Credit/No Credit grading only. Not open to students with credit for CHEM 458. 1 laboratory. Prerequisite: CHEM 319.

CHEM 458 Instrumental Organic Qualitative Analysis (3)
Separation, purification, and identification of organic molecules using chemical and instrumental methods, including nuclear magnetic resonance, infrared and ultraviolet spectroscopy and mass spectroscopy, and techniques in high resolution FT-NMR. 1 lecture, 2 laboratories. Prerequisite: CHEM 319.

CHEM 459 Undergraduate Seminar (2)
Oral presentation of current developments in chemistry based on current literature. Searching for, organizing and presenting developments from current literature in chemistry and biochemistry. Preparation for employment and for independent work, including senior project, in chemistry and biochemistry. 2 seminars. Prerequisite or corequisite: CHEM 318 and junior standing.

CHEM 461 Senior Project Report (1)
Completion of a senior project report under faculty supervision. Minimum 30 hours time commitment. Prerequisite: CHEM 459 and consent of instructor.

CHEM 463 Honors Research (1)
Advanced laboratory research. Results are presented in a poster session or other public forum. 1 laboratory. Prerequisite: CHEM 461 and consent of instructor.

CHEM 465 College Teaching Practicum (1–2) (CR/NC)
Teaching assignment in an undergraduate college classroom. Includes teaching and related activities under the direction of a permanent faculty member in the Department of Chemistry and Biochemistry. Total credit limited to 4 units. Prerequisite: Junior standing, CHEM 231/331 (or permission of instructor), evidence of satisfactory preparation in chemistry. Department chair approval required.

CHEM 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: CHEM 305, or CHEM 351, or CHEM 217/317 or consent of instructor.

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CHEM 471 Selected Advanced Laboratory (1–4)
Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1–4 laboratories. Prerequisite: Consent of instructor.

CHEM 472 Plant Biochemistry (3)
Application of plant biochemistry, molecular biology and physiology to topics, including plant secondary metabolism, defense mechanisms, drought tolerance, functional genomics, advanced photosynthesis, circadian rhythms, manipulation of plants for improved nutrition, other current research topics. 3 lectures. Prerequisite: CHEM 313 or CHEM 371 or BIO 435.

CHEM 473 Immunoochemistry (3)
Theory and practice of immunoochemistry including the structure, genetics, chemical modification and production of antibodies, immunoochemical techniques and the biochemistry of the immune defense process. Not open to students with credit in BIO 426. 3 lectures. Prerequisite: CHEM 371 or consent of instructor. Recommended: CHEM 373 or BIO 351.

CHEM 474 Protein Techniques Laboratory (2)
Experiments in protein affinity chromatography, electrophoresis and blotting, immunoprecipitation techniques, antibody-enzyme conjugation, and immunoassay. 2 laboratories. Prerequisite: CHEM 371 or consent of instructor.

CHEM 476 Gene Expression Laboratory (2) (Also listed as BIO 476)
Heterologous gene expression of a recombinant protein in a microbial system: gene cloning, construction of expression plasmid, DNA sequence analysis, transformation of microbial host, selection and analysis of transformed host cells, expression and purification of recombinant protein. 2 laboratories. Prerequisite: BIO/CHM 375; CHEM 313 or CHEM 371; MCRO 433. Changed effective Fall 2006; see Updates.

CHEM 477 Biochemical Pharmacology (3)
Consideration of current selected topics in pharmacology and drug targeting. 3 lectures. Prerequisite: CHEM 377 or consent of instructor.

CHEM 478 Pharmaceutical Development (3)
Process of drug development from research clinical candidate to market. Chemical process development, including synthesis optimization, scale up, pilot plant work, manufacturing, and good manufacturing procedure (GMP's). Role of pharmacetics in drug development, including various forms of formulation, analytical development requirements, and quality assurance. Project planning and timeline management, clinical trials, and regulatory affairs, including FDA filings. 3 lectures. Prerequisite: CHEM 318.

CHEM 481 Inorganic Chemistry (3)
A systematic study of chemical and physical properties of inorganic compounds based on periodic groupings with emphasis on chemical bonding and structure. Topics will include coordination chemistry and kinetics, organometallic chemistry, advanced acid-base relationships and bonding theories plus other selected topics. 3 lectures. Prerequisite: CHEM 352, and CHEM 231/331 or consent of instructor.

CHEM 484 Inorganic Chemistry Laboratory (2)
Laboratory techniques in inorganic chemistry. Synthetic and analytic techniques as applied to inorganic and organometallic chemistry. 2 laboratories. Prerequisite: CHEM 481.

CHEM 485 Cooperative Education Experience (6) (CR/NC)
Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. 2 units only applicable to approved chemistry electives. Total credit limited to 16 units. Credit/No Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

CHEM 495 Cooperative Education Experience (12) (CR/NC)
Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. 2 units only applicable to approved chemistry electives. Total credit limited to 16 units. Credit/No Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

CHEM 500 Special Problems for Graduate Students (1-3)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 6 units, with a maximum of 3 units per quarter. Prerequisite: Graduate standing and consent of department chair.

CHEM 528 Nutritional Biochemistry (3)
Nutritional aspects of biochemistry. Lecture, library research and student presentations. Topics include vitamins and minerals, essential and energy providing nutrients, deficiency, degenerative and genetic diseases of metabolism. Emphasis on current research and controversy. 3 seminars. Prerequisite: CHEM 313 or CHEM 372 or consent of instructor.

CHEM 544 Polymer Physical Chemistry and Analysis (3)
Physical properties of polymers and coatings and their measurement; molecular weight averages, glass transition, thermodynamics of polymers, viscoelastic properties, rheology; molecular weight determination, thermal analysis, spectroscopic analysis, mechanical testing, atomic force microscopy. Not open to students with credit in CHEM 444. 3 lectures. Prerequisite: CHEM 351.

CHEM 545 Polymer Synthesis and Mechanisms (3)
Polymerization methods and mechanisms; chemistry of initiators, catalysts and inhibitors; use of representative types; synthesis, film formation, structure and properties of polymers commonly used in coatings and adhesives. Polymer nomenclature. Not open to students with credit in CHEM 445. 3 lectures. Prerequisite: CHEM 317 or equivalent.

CHEM 547 Polymer Characterization and Analysis Laboratory (2)

CHEM 548 Polymer Synthesis Laboratory (2)

CHEM 550 Coatings Formulation Principles (3)
Formulation of modern coatings. Raw materials including resins, solvents, pigments, and additives. Formulation principles for solvent-borne and high solids coatings, water-borne coatings, powder coatings, radiation cure coatings and architectural coatings. Regulatory issues; VOC’s. Coating properties, film formation, film defects, application methods, color and color acceptance. 3 lectures. Prerequisite: CHEM 444 or CHEM 544.

CHEM 551 Coatings Formulation Laboratory (2)

CHEM 570 Directed Graduate Study (3)
Directed graduate study in specialized advanced topics related to graduate internship. Topics developed jointly by faculty research advisor and industrial research supervisor. Available only to students while on graduate industrial internship. Topics chosen to highlight the industrial experience. Student expected to work independently and report weekly to
CM–CONSTRUCTION MANAGEMENT

CM 211 Construction Drawings and Specifications (4)
Basic skills and techniques required to produce construction drawings and specifications conforming to current building codes and standards, including using manual drawing techniques and Computer Aided Drafting. Laboratory assignments develop visualization skills in order to examine the integration of construction systems, architectural conventions, organization of working drawings and specifications. 4 laboratories. Prerequisite: Consent of department head and ARCH 105 and ARCH 106.

CM 212 Fundamentals of Construction Management (3)
Introduction to the fundamental concepts of construction management. Primary areas of focus are quantity surveying and basic scheduling techniques. Additional topics of study to include work activity durations and sequencing, and computer applications in scheduling. 3 laboratories. Prerequisite: CM 211.

CM 221 Concrete Technology (3)
Modern concepts which form the basis for solutions to problems of concrete construction. Includes significant developments in concrete chemistry and strength theory. Concrete mix design, physical properties of concrete, use of admixtures, concrete batching, curing and testing. Includes physical testing of designed mixes. 2 lectures, 1 laboratory. Prerequisite: ARCH 105 and ARCH 106.

CM 315 Fiscal and Project Feasibility (4) (Also listed as CRP 315)
Analysis of the revenue streams and costs involved in project development. Impact analysis of costs and revenues on private and public sectors included. Construction of pro-formas for various project types. 3 lectures, 1 laboratory. Prerequisite: Completion of GE Area D2.

CM 325 Construction Management Practices (3)
Overview of construction methods, building systems, construction and contract documents, cost estimating and scheduling and other practices used in the contracting process. For non-majors. 2 lectures, 1 activity. Prerequisite: Minimum junior standing or consent of instructor.

CM 331 Construction Accounting (3)
Fundamentals of construction accounting principles to include income recognition, job cost control, cash flow analysis and associated cost reports. 3 lectures. Prerequisite: BUS 215, and either BUS 212 or BUS 214.

CM 332 Evaluation of Cost Alternatives (3)
Basic principles of economic evaluations using fundamental concepts of time value of money to compare cost alternatives related to construction, design, and real property development. 3 lectures. Prerequisite: Completion of GE Area D2 and MATH 142 or MATH 182.

CM 333 Construction Contracts and Law (3)
Legal and contractual aspects of the construction industry. Topics of study to include the different types of contracts and clauses associated with the various project delivery systems. 3 lectures. Prerequisite: BUS 207.

CM 341 Residential Construction Practices (3)
Materials, methods, and techniques associated with residential and light commercial construction operations. Topics of study to include shallow foundation systems, structural framing systems (timber and masonry), roofing systems, and exterior and interior finish systems. 3 laboratories. Prerequisite: CM 212.

CM 342 Commercial Construction Practices (3) (Corrected effective Summer 2007: see Updates)
Materials, methods, and techniques associated with large commercial construction operations. Topics of study to include earth retaing and foundation systems, structural framing systems (steel and concrete), roofing and exterior cladding systems, conveyance systems, and interior finish systems. 3 laboratories. Prerequisite: CM 212.

CM 343 Heavy Civil Construction Practices (3)
Materials, methods and techniques associated with heavy civil construction operations. Topics of study to include earthwork and associated heavy equipment, roadway work, bridge work, and various other types of heavy civil construction operations. 3 laboratories. Prerequisite: CM 212 and CM 221.

CM 350 Computer Applications in Construction Management (2)
Application of computer systems to control construction operations in the building industry. Development of construction management games. 2 lectures. Prerequisite: CSC 110 or ARCH 250.

CM 352 Electrical Systems for Buildings (3)
Materials, methods and techniques associated with the construction and installation of electrical power systems, lighting systems, and other wiring systems within the building. Additional topics of study to include electrical power generation and distribution to the building. 3 laboratories. Prerequisite: CM 212.

CM 353 Mechanical Systems for Buildings (3)
Materials, methods and techniques associated with the construction and installation of HVAC (Heating, Ventilating, and Air Conditioning) systems, plumbing systems and fire suppression systems within the building. Additional topics of study to include domestic water supply to the building and drainage systems (storm drains and sewers) from the building. 3 laboratories. Prerequisite: CM 212.

CM 364 Construction Jobsite Management (3)
Procedures, methods and documentation associated with project level management of the construction process. Administrative roles and managerial relationships among the various members of the project team, primarily constructors, designers and owners. 3 laboratories. Prerequisite: CM 212.

CM 400 Special Problems for Advanced Undergraduates (1–2)
Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of instructor. Changed effective Spring 2009; see Updates.

CM 430 Collaborative Process (3) (Also listed as EDES 430)
A comprehensive set of tools and practices that allow for high performance, interdisciplinary collaborative teams to focus on extraordinary outcomes at each step of project development, including planning, design, bidding, permitting, construction and management phases. 3 activities. Prerequisite: Minimum junior standing or consent of instructor.

CM 431 Integrated Project Services (3) (Also listed as EDES 431)
Overview of project delivery methods with an emphasis on trends in integrated services project delivery. Integrated services entity organization structures, process variations, procurement and selection methodologies. Integration of planning, design and construction efforts to achieve maximum project quantity and value. 3 laboratories. Prerequisite: Minimum senior standing.

CM 432 Design-Build Project Management (3)
Management issues applicable to the design and construction integration method of project delivery. Project sponsor/project advocate techniques, monitoring the evolving design, detecting and controlling change, early warning systems, cost trending, schedule impacts, cost impacts, systems integration, contract/cope modifications, procurement, contingencies, quality, and overall process control. 3 activities. Prerequisite: Minimum junior standing.
CM 435 Capital Projects Planning (4)
Planning, programming, and management requirements of owner and end-users in relationship to the design and construction of capital projects, improvements, and facilities. Identification of facility requirements, and coordination of the physical workspace, its people, and the work of the organization with the design and construction process. 4 activities. Prerequisite: CM 332, CM 431.

CM 443 Management of the Construction Firm (3)
Applications of strategic management techniques and business strategy for the long-range direction of the construction firm. 3 activities. Prerequisite: CM 341, CM 342, CM 343, CM 352, CM 353 and CM 364.

CM 444 Concrete Formwork and Other Temporary Structures (3)
Materials, methods and techniques associated with concrete formwork construction. Design and analysis of vertical and horizontal formwork systems. Additional topics of study to include temporary earth retention systems (large excavations and trenches), dewatering systems, access scaffolding, and various other temporary structures utilized in building construction. 3 activities. Prerequisite: CM 341, CM 342, CM 343, CM 352, CM 353 and CM 364, and ARCE 226.

CM 452 Project Controls (3)
Planning, organization, scheduling, and control of construction projects including cost control and resource control. Use of Critical Path Method (CPM) in planning and scheduling computer applications for CPM. 3 laboratories. Prerequisite: CM 341, CM 342, CM 343, CM 352, CM 353 and CM 364.

CM 454 Construction Estimating (3)
Methods, procedures and computer applications associated with estimating the costs of construction projects. Additional topics of study to include analysis of the bidding process and conceptual estimating. 3 laboratories. Prerequisite: CM 341, CM 342, CM 343, CM 352, CM 353 and CM 364.

CM 461, 462 Senior Project I, II (2) (1-2)
Selection and completion of a comprehensive project under faculty supervision. Problems to involve the student's technical and creative skills. Student proposal must be submitted and approved by project advisor and department head prior to registration for course. Construction and team projects encouraged. Prerequisite: Consent of project advisor and department head. See department for additional guidelines and requirements.

CM 463 Senior Project: Professional Practice for Constructors (3)
Practical application of construction management theory and practice solving problems related to the built environment. 3 laboratories. Prerequisite: CM 452 and CM 454.

CM 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Consent of instructor.

CM 471 Selected Advanced Laboratory (1–4)
Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1–4 laboratories. Prerequisite: Consent of instructor.

CM 475 Real Property Development Principles (4)
Development process and its major actors: investors, developers, government agencies, environmental and local stakeholders; their development roles, objectives, approaches. Basics of urban markets and economics, financing, regulation, public planning; value added, contractual, environmental and community context factors. 4 lectures. Prerequisite: Minimum junior standing.

CM 485 Cooperative Education Experience (3-6) (CR/NC)
Full-time work experience in an area directly related to the construction industry for 3 months. Positions are paid and usually require relocation and registration in course for one quarter. Registration in course is required at start of work experience. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. May be repeated for credit. Total credit limited to 16 units. See department for additional requirements. Prerequisite: Consent of instructor.

CM 495 Cooperative Education Experience (12) (CR/NC)
Full-time work experience in an area directly related to the construction industry for 6 months. Positions are paid and usually require relocation for two consecutive quarters. Registration in course is required at start of work experience. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. May be repeated for credit. Total credit limited to 16 units. See department for additional requirements. Prerequisite: Consent of instructor.

CM 531 Construction Cost and Material Control (3)
Advanced theory and practice of cost and material control for construction projects. Emphasis on computer applications. 2 lectures, 1 activity. Prerequisite: CM 331 or consent of instructor.

CM 533 Case Histories in Contract Administration (3)
Common points of disputes between design professional, owner, and contractor. Methods of avoidance and dispute resolution. 3 activities. Prerequisite: CM 333, 4th year architectural practice or consent of instructor.

CM 542 Advanced Construction Estimating (3)
Advanced theory and practice of cost estimating techniques. Includes standard, conceptual and parameter estimating; bidding strategies, value engineering concepts, and risk analysis. Emphasis on computer applications. 2 lectures, 1 activity. Prerequisite: CM 454 or consent of instructor.

CM 552 Construction Project Scheduling (3)
Basic and advanced network scheduling techniques as applied to architectural building projects. Emphasis on computer applications. 2 lectures, 1 activity. Prerequisite: CM 542 or consent of instructor.

CM 570 Selected Advanced Topics in Construction Management (4)
Directed study of selected topics in Construction Management. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars. Prerequisite: Graduate standing or consent of instructor.

COMS--COMMUNICATION STUDIES

COMS 101 Public Speaking (4) (Also listed as HNRS 101) GE A2
Introduction to the principles of public speaking. Practical experience in the development, presentation, and critical analysis of speeches to inform, to persuade, and to actuate. Not open to students with credit in COMS 102. 4 lectures.

COMS 102 Principles of Speech Communication (4) GE A2
Introduction to the fundamentals and principles which underlie effective speech communication. Practical experience in various types of speaking situations: informative speaking, persuasive speaking, and panel discussion. Not open to students with credit in COMS 101. 4 lectures.

COMS 126 Argument and Advocacy (4) GE A3
The nature of critical thinking as applied in written and oral argument. Analysis of inductive and deductive reasoning. Analysis of reasoning, argument, forms of support and fallacies of argument and language. Instruction in and practical experience in writing sound persuasive arguments and engaging in oral argumentation assignments. 4 lectures. Prerequisite: Completion of GE Area A1 or A2.

COMS 145 Reasoning, Argumentation, and Writing (4)
(Also listed as ENGL/HNRS 145) GE A3
The principles of reasoning in argumentation. Examination of rhetorical principles and responsible rhetorical behavior. Application of these principles to written and oral communications. Effective use of research methods and sources. 4 lectures. Prerequisite: Completion of GE Area A1 or A2.

COMS 201 Advanced Public Speaking (4)
Further consideration of the principles of public address. Advanced practice in manuscript, extemporaneous, and impromptu speaking. 4 lectures. Prerequisite: COMS 101 or COMS 102.
COMS 208 Performance of Literature (4)  GE C3
Poetry, prose, nonfiction and dramatic literature performed to communicate the levels of meaning within each work to the audience. Communication Studies majors will not receive GE C3 credit. 4 lectures. Prerequisite: Completion of GE Areas A and C1.

COMS 212 Interpersonal Communication (4)
Introduction to the interaction process in two-person (dyadic) communication settings. Emphasis on the functions of varying messages in the initiation, development, maintenance and termination of personal relationships. 4 lectures. Prerequisite: COMS 101 or COMS 102.

COMS 213 Organizational Communication (4)
Introduction to communication within the organization and between the organization and its environment. Effects of networks, superior/subordinate message patterns, team building, climate, message flow patterns and distortion on organizational effectiveness. 4 lectures. Prerequisite: COMS 101 or COMS 102.

COMS 217 Small Group Communication (4)
Basic principles and techniques of small group communication. Survey of the importance of discussion in contemporary society, including study of and practice in informal group discussion, panel discussion, symposium, and forum. 4 lectures. Prerequisite: COMS 101 or COMS 102.

COMS 226 Applied Argumentation (4)
Intermediate level course in the theory and practice of everyday argument. Select theories of argumentation, and practical experience arguing in a wide variety of contexts. 4 lectures. Prerequisite: Completion of GE Area A3.

COMS 250 Forensic Activity (2)
Introduction to competitive debate activities. Research, analysis, and debating about contemporary issues. Any student who wishes to receive academic credit for participation in such activities during the quarter should enroll. Total credit limited to 6 units. 2 laboratories. Prerequisite: COMS 101 or COMS 102 or equivalent experience.

COMS 301 Business and Professional Communication (4)
Communication skills and functions for all levels of organizational employees. Interviewing, oral briefings, motivational and conference speaking. 4 lectures. Prerequisite: COMS 101 or COMS 102.

COMS 308 Group Performance of Literature (4)  GE C4
Examination and experience in the various modes of group performance of literature: Readers Theatre, Chamber Theatre, Story Theatre. Scripting; directing; performing and critiquing of group performance of literature. 4 lectures. Prerequisite: Completion of GE Areas A, C3 and junior standing. Communication Studies majors will not receive GE C4 credit.

COMS 311 Communication Theory (4)
Survey of human communication theories including interpersonal, small group, organizational, persuasion, nonverbal, intercultural, and media. Philosophical foundations for understanding communication from a social science perspective. 4 lectures. Prerequisite: Completion of GE Area A.

COMS 312 Communication Research Methods (4)
Exploration of communication research strategies and methodologies. Basic methods of designing research in empirical communication studies. 4 lectures. Prerequisite: COMS 311 and STAT 217, junior standing. For majors only.

COMS 315 Intergroup Communication (4)
Survey of theory and research concerning language and communication between various social groups (e.g., age, sex, race, sexual orientation), with an emphasis on understanding the role verbal, nonverbal, and mass communication plays in identity formation and differentiating group members. 4 lectures. Prerequisite: Completion of GE Area A.

COMS 317 Technology and Human Communication (4)
Impact of technological change upon human communication. Past, present, and future technological developments that have affected how humans communicate. Emphasis on new communication technologies. 4 lectures. Prerequisite: Completion of GE Area B, and junior standing.

COMS 322 Persuasion (4)
Theory of persuasion with particular emphasis upon social psychological principles of influence. Analysis of various forms of persuasion, social influence and propaganda. 4 lectures. Prerequisite: Completion of GE Area A.

COMS 330 Classical Rhetorical Theory (4)
Early development of rhetorical theory in Greco-Roman civilization. Analysis of the canons of rhetoric. Rhetorical thought of Sophists, Isocrates, Plato, Aristotle, Cicero and Quintilian. 4 lectures. Prerequisite: Completion of GE Area A requirements and junior standing.

COMS 331 Contemporary Rhetorical Theory (4)
Rhetoric's role in contemporary culture. Issues: political advocacy; science, technology and mass persuasion; ethics and rhetoric. Representa-tive theorists: Burke, Weaver, Richards, Toulmin and McLuhan. 4 lectures. Prerequisite: Completion of GE Area A and junior standing.

COMS 332 Rhetorical Criticism (4)
Theory and method used in the analysis and evaluation of rhetorical discourse. Study of critical essays. Practice in interpreting and evaluating persuasive discourse. 4 lectures. Prerequisite: Junior standing, COMS 330.

COMS 350 Advanced Forensic Activity (2)
Advanced participation in intercollegiate speech activities. Intercollegiate tournament competition, judging speech competition and other communication-related public service on campus and in the community. Total credit limited to 6 units. 2 laboratories. Prerequisite: COMS 250.

COMS 385 Media Criticism (4)
Theory and method used in analyzing media from critical, rhetorical, and cultural perspectives. Practice in interpreting and evaluating news, advertising, prime-time television, the Internet, and other mass-mediated texts, with special attention to relationships among media, identity, and political action. 4 lectures. Prerequisite: Completion of GE Area A, and junior standing.

COMS 400 Special Problems for Advanced Undergraduates (1–2)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units. Prerequisite: Consent of instructor, junior standing.

COMS 413 Advanced Organizational Communication (4)
Describing and measuring the organization's human message system. Planning and implementing communication training and development for the organization. New functions, careers and opportunities for the communication professional. 4 lectures. Prerequisites: Junior standing, COMS 301.

COMS 416 Intercultural Communication (4)  USCP
Examination and clarification of cultural aspects of communication within and among ethnic groups. 4 lectures. Prerequisite: Completion of GE Area A.

COMS 418 Health Communication (4)
Communication in health contexts. Topics include interpersonal communication (e.g., health professional/patient), group and organizational communication (e.g., health-related groups), and mass communication (e.g., persuasive health campaigns). Open to all majors and valuable to laypersons who are consumers of health care, and pre-health professionals. 4 lectures. Prerequisite: Completion of GE Area A, and junior standing.

COMS 419 Media Effects (4)
Effects of media on the individual. Influence of mediated message producers, production technologies, and message content. Empirical approaches to data collection using experimental and survey techniques. 4 lectures. Prerequisite: Completion of GE Area A and junior standing.

COMS 420 Nonverbal Communication (4)
Influence of kinesic, proxemic, artifactual, olfactory, paralinguistic and environmental factors in human communication. Theory, research and practice in nonverbal communication. 4 lectures. Prerequisite: Completion of GE Area A.
COMS 421 Gender and Communication (4)
Examination of gender in a variety of communication contexts. Concepts presented will help students understand the theory and practice of communication with members of the same and opposite sex. 4 lectures.
Prerequisite: Completion of GE Area A and junior standing.

COMS 424 Classroom Communication (4)
Exploration of classroom communication development. Student-teacher-parent interaction. Communication style, environmental stimuli, dialectical differences and bilingualism, measurement of communication competence. 4 lectures. Prerequisite: Junior standing. Completion of GE Area A.

COMS 435 American Political Rhetoric (4)
Role of oratory in American political and social history since Lincoln. Historical and rhetorical analyses of important political speeches delivered by presidents, activists, demagogues, and leaders of social movements. 4 lectures. Prerequisite: Junior standing.

COMS 450 Internship: Speech Communication (2–4) (CR/NC)
Supervised practicum and application of principles and theories of communication in organizational settings. Total credit limited to 8 units. Credit/No Credit grading only. Prerequisite: Junior standing, 2.5 GPA, and consent of instructor.

COMS 460 Undergraduate Seminar (1)
Discussion and design of individual projects, oral reports on material in current professional writings. 1 seminar. Prerequisite: Completion of COMS 311, COMS 312, COMS 330 and COMS 332, and junior standing. For majors only.

COMS 461 Senior Project (3)
Completion of approved project under faculty supervision. Project results are presented in a formal written report. Minimum 90 hours total time. Prerequisite: COMS 460. For majors only.

COMS 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1–4 lectures. Prerequisite: Junior standing. Completion of GE Area A.

COMS 485 Cooperative Education Experience (6) (CR/NC)
Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 16 units. Credit/No Credit grading only. Prerequisite: 2.5 GPA and consent of instructor.

CPE–COMPUTER ENGINEERING

CPE 100 Computer Engineering Orientation (1) (CR/NC)
Introduction to the computer engineering discipline. Success skills and curricular information. Career paths and opportunities. Professional aspects of engineering and computer science. Interaction with upper division students, alumni, faculty and staff. Introduction to computer software and hardware. Credit/No Credit grading only. 1 lecture.

CPE 101 Fundamentals of Computer Science I (4)
(Also listed as CSC 101)
Basic principles of algorithmic problem solving and programming using methods of top-down design, stepwise refinement and procedural abstraction. Basic control structures, data types, and input/output. Introduction to the software development process: design, implementation, testing and documentation. The syntax and semantics of a modern programming language. Credit not available for students who have taken CSC/CPE 108. 3 lectures, 1 laboratory. Prerequisite: MATH 118 (or equivalent) with a grade of C- or better, and basic computer literacy (CSC 100 or CSC 232 or equivalent).

CPE 102 Fundamentals of Computer Science II (4)
(Also listed as CSC 102)
Basic design, implementation, testing, and documentation of object-oriented software. Introduction to classes, interfaces, inheritance, algorithms (sort, search, recursion), abstract data types, data structures (lists, stacks, queues), file I/O, and exceptions. Credit not available for students who have taken CSC/CPE 108. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 101 with a C- grade or better and either MATH 141 or MATH 221 with a C- grade or better. Corequisite: CSC 141.

CPE 103 Fundamentals of Computer Science III (4)
(Also listed as CSC 103)
Introduction to data structures and analysis of algorithms. Abstract data types. Specification and implementation of advanced data structures. Theoretical and empirical analysis and proofs of properties of recursive and iterative algorithms. Software performance evaluation and testing techniques. 3 lectures, 1 laboratory. Prerequisite: CPE 102 with a C- grade or better and CSC 141 with a C- grade or better.

CPE 108 Accelerated Introduction to Computer Science (4)
(Also listed as CSC 108)
Accelerated introduction to basic principles of algorithmic and object-oriented problem solving and programming. Introduction to programming language concepts including control structures, data types, classes, and inheritance. Program design principles. Use and implementation of algorithms (searching, sorting, recursion) and data structures (lists, stacks, and queues). Intended for students with experience in algorithmic problem solving and using basic control structures and data types in a modern programming language (CSC/CPE 101), but who are not ready for CSC/CPE 102. Credit not available for students who have taken CSC/CPE 102. 3 lectures, 1 laboratory. Prerequisite: Math 118 (or equivalent) with a grade of C- or better, significant experience in computer programming, and consent of instructor. Corequisite: CSC 141.

CPE 129 Digital Design (3) (Also listed as EE 129)
Number systems, Boolean algebra, Boolean functions, and minimization. Analysis and design of combinational logic circuits. Feedback circuits. Analysis and design of sequential logic circuits. Applying Hardware Description Language (HDL) to synthesize digital logic circuits in Programmable Logic Devices (PLDs). 3 lectures. Prerequisite: An orientation course in student’s major (EE 111/151 for EE students, CPE 100 for CPE students), CPE/CSC 101. Concurrent: CPE 169.

CPE 169 Digital Design Laboratory (1) (Also listed as EE 169)
Experiments to analyze and design combinational and sequential logic circuits with discrete ICs and PLDs. Introduction to laboratory equipment such as the logic state analyzer for testing circuits. Introduction to a hardware description language for logic simulation and design. 1 laboratory. Prerequisite: An orientation course in student’s major (EE 111/151 for EE students, CPE 100 for CPE students), CPE/CSC 101. Concurrent: CPE 129.

CPE 200 Special Problems for Undergraduates (1–2)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of instructor.

CPE 229 Computer Design and Assembly Language Programming (3) (Also listed as EE 229)
Design and implementation of digital computer circuits via CAD tools for programmable logic devices (PLDs). Basic computer design with its data path components and control unit. Introduction to assembly language programming of an off-the-shelf RISC-based microcontroller. 3 lectures. Prerequisite: CPE 129&169 with a C- grade or better. Concurrent: CPE 269.

CPE 235 Fundamentals of Computer Science for Scientists and Engineers I (4) (Also listed as CSC 235)
Introduction to the fundamentals of computer programming with an emphasis on mathematical, scientific and engineering applications: principles of algorithmic problem solving and procedural programming using a modern programming language, data types, elementary data structures, input/output and control structures. Not a substitute for
CSC/CPE 101 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: MATH 141 or MATH 161 with a grade of C- or better, or consent of instructor.

CPE 236 Fundamentals of Computer Science for Scientists and Engineers II (4) (Also listed as CSC 236)
Further study of computer program development with an emphasis on mathematical, scientific and engineering applications. Introduction to more complicated data types and structures. Practice of more complicated techniques of procedural programming. Introduction to the principles of object-oriented programming using a modern programming language. Detailed discussion of lists and classic list algorithms, algorithm analysis, multidimensional arrays, records, dynamic data structures, file input/output, classes. Not a substitute for CSC/CPE 102 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 235 with a grade of C- or better, or consent of instructor.

CPE 237 Introduction to Computer Science with Applications I (4) (Also listed as CSC 237)
Introduction to the fundamentals of computer science using a modern programming language. Includes principles of algorithmic problem solving, data types, elementary data structures, input/output, control structures, classes and methods. Not a substitute for CSC/CPE 101 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: MATH 221 or STAT 252 with a grade of C- or better, or consent of instructor.

CPE 238 Introduction to Computer Science with Applications II (4) (Also listed as CSC 238)
Continuation of CPE 237. Intermediate study of computer program development using a modern object oriented (OO) programming language. Further study of OO principles including inheritance and interfaces. Introduction to implementation of Graphical User Interfaces, multi-media, streams, database connection, and scripting. Not a substitute for CPE/CSC 102 or for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 237 with a grade of C- or better.

CPE 269 Computer Design and Assembly Language Programming Laboratory (1) (Also listed as EE 269)
Experiments to design and test digital computer circuits and systems with programmable logic devices (PLDs). Design projects to implement a basic computer with data path components and control. Assembly language programming projects for an off-the-shelf RISC-based microcontroller. 1 laboratory. Prerequisite: CPE 129&169 with a C-grade or better.
Concurrent: CPE 229.

CPE 270 Computer Graphics Applications (4) (Also listed as CSC 270)
Use of common graphics applications packages. Business graphics, figure editing, animation and image editing, photorealistic image generation, scientific visualization and multimedia. 2 lectures, 2 activities.

CPE 300 Professional Responsibilities (4) (Also listed as CSC 300)
The responsibilities of the computer science professional. The ethics of science and the IEEE/ACM Software Engineering Code of Ethics. Quality tradeoffs, software system safety, intellectual property, history of computing and the social implications of computers in the modern world. Applications to ethical dilemmas in computing. Technical presentation methods and practice. 3 lectures, 1 laboratory. Prerequisite: CPE/CSC 307 or CSC/CPE 309.

CPE 305 Individual Software Design and Development (4) (Also listed as CSC 305)
Practical software development skills needed for construction of mid-sized production-quality software modules, using the CSC upper division programming language. Topics include inheritance, exceptions, and memory and disk-based dynamic data structures. Students must complete an individual programming project of mid-level complexity. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 353 or CSC/CPE 357.

CPE 307 Introduction to Software Engineering (4) (Also listed as CSC 307)
Requirements, specification, design, implementation, testing and verification of large software systems. Study and use of the software process and software engineering methodologies; working in project teams. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better, and CSC/CPE 357. Not open to students with credit in CSC/CPE 308.

CPE 308 Software Engineering I (4) (Also listed as CSC 308)
Principles for engineering requirements analysis and design of large complex software systems. Software process models. Methods of project planning, tracking, documentation, communication, and quality assurance. Analysis of engineering tradeoffs. Group laboratory project. Technical oral and written presentations. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better, and CSC/CPE 357 or CSC/CPE 353.

CPE 309 Software Engineering II (4) (Also listed as CSC 309)
Continuation of the software lifecycle. Methods and tools for the implementation, integration, testing and maintenance of large software systems. Software development and test environments. Software quality assurance. Group laboratory project. Technical presentation methods and practice. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 308.

CPE 315 Computer Architecture (4) (Also listed as CSC 315)
In-depth study of the instruction set architecture and hardware design of a specific CPU. Introduction to pipelines, input/output and multi-processors. Computer abstractions and performance measurement. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 and either CPE/EE 229 or CSC 225.

CPE 316 Micro Controllers and Embedded Applications (4) (Also listed as CSC 316)
Introduction to micro controllers and their applications as embedded devices. Hardware/software tradeoffs, micro controller selection, use of on-chip peripherals, interrupt driven real-time operation, A/D conversion, serial and parallel communications, watch-dog timers, low power operation and assembly language programming techniques. 3 lectures, 1 laboratory. Prerequisite: CPE/CSC 315 or CPE/EE 329.

CPE 329 Programmable Logic and Microprocessor-Based Systems Design (4) (Also listed as EE 329)
Design, implementation and testing of programmable logic microprocessor-based systems. Hardware/software tradeoffs (such as timing analysis and power considerations), system economics of programmable logic and microprocessor-based system design. Interfacing hardware components (such as ADCs/DACs, sensors, transducers). 3 lectures, 1 laboratory. Prerequisite: EE 307&347 with a C- grade or better, CPE 229&269 with a C- grade or better.

CPE 336 Microprocessor System Design (4) (Also listed as EE 336)
Introduction to microcontrollers and integrated microprocessor systems. Emphasis on the Intel 8051 and Motorola 68HC12 families and derivatives. Hardware/software trade-offs, system economics, and functional configurations. Interface design, real-time clocks, interrupts, A/D conversion, serial and parallel communications, watch-dog timers, low power operation, and assembly language programming techniques. Architecture and design of sampled data and digital control systems. Case studies of representative applications. 3 lectures, 1 laboratory. Prerequisite: CPE 129&169 with a C- grade or better.

CPE 350 CPE Capstone Preparation (4)
Definition and specification of a system to be constructed in CPE 450; requirements elicitation techniques, research and data gathering methods; project planning, time and budget estimating; project team organization. Ethics and professionalism. 3 lectures, 1 laboratory. Prerequisite: CPE 329, may be concurrent.

CPE 353 Systems Programming for Software Engineers (4) (Also listed as CSC 353)
Assembly language and C programming; 1/O and systems level programming; interrupt handlers. Technical elective credit not allowed for CSC/CPE majors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better.

CPE 357 Systems Programming (4) (Also listed as CSC 357)
C programming language from a system programming perspective. Standard C language including operators, 1/O functions, and data types in
the context of system functions. Unix commands, shell scripting, file system, editors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better, and either CSC 225 or CSC/CPE 229.

CPE 365 Introduction to Database Systems (4)
(Also listed as CSC 365)
Basic principles of database management systems (DBMS) and of DBMS application development. DBMS objectives, systems architecture, database models with emphasis on Entity-Relationship and Relational models, data definition and manipulation languages, the Structured Query Language (SQL), database design, application development tools. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103.

CPE 366 Database Modeling, Design and Implementation (4)  (Also listed as CSC 366)

CPE 369 Distributed Computing I (4)  (Also listed as CSC 369)
Introduction to distributed computing paradigms and protocols: interprocess communications, group communications, the client-server model, distributed objects, and Internet protocols. Emphasis on distributed software above the operating system and network layers. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357 or CSC/CPE 353.

CPE 400 Special Problems for Advanced Undergraduates (1–4)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units. Prerequisite: Consent of instructor.

CPE 402 Software Requirements Engineering (4)
(Also listed as CSC 402)
Software requirements elicitation, analysis and documentation. Team process infrastructure and resource estimation to support appropriate levels of quality. Software architectural design. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 307 or CSC/CPE 309; CSC/CPE 305.

CPE 405 Software Construction (4)  (Also listed as CSC 405)
Design and construction of sizeable software products. Technical management of software development teams. Software development process models, software design, documentation, quality assurance during development, software unit and integration testing; CASE tools, development environments, test tools, configuration management. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 402.

CPE 406 Software Deployment (4)  (Also listed as CSC 406)
Deployment of a sizeable software product by a student team. Software maintenance and deployment economic issues. Management of deployed software: version control, defect tracking and technical support. 3 lectures, 1 laboratory. Prerequisite: CPE/CSC 405.

CPE 409 Current Topics in Software Engineering (4)
(Also listed as CSC 409)
Selected topics in software engineering. Topics may include program generation, quality assurance, formal methods, software metrics, design methods, testing, or software development processes. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 309 or CSC/CPE 307.

CPE 415 Microcomputer Systems (4)
Recent advances in microcomputer architectures. RISC, parallel processing advances, and component communication. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 315.

CPE 416 Autonomous Mobile Robotics (4)  (Also listed as CSC 416)
Theory and application of concepts relevant to autonomous mobile robots. Sensor and actuator interfacing, programming mobile robots, mobile robot configurations, software architectures and algorithms. 3 lectures, 1 laboratory. Prerequisite: CPE/EE 329 or both CSC/CPE 315 and CSC/CPE 357 or consent of instructor.

CPE 427 Digital Computer Subsystems (4)  (Also listed as EE 427)
Design of components and subsystems in digital computers. Use of modern techniques and devices (CPLDs and FPGAs) in implementation. Consideration given to cost/speed tradeoffs. Implementation of a basic digital computer using pre-designed subsystems. 3 lectures, 1 laboratory. Prerequisite: CPE 329 with a C- grade or better.

CPE 430 Programming Languages I (4)  (Also listed as CSC 430)
Construction of the front end of a compiler including lexical analysis, syntactic analysis, type checking, and formal semantics. Introduction to regular languages, finite automata, and context-free grammars. 3 lectures, 1 laboratory. Prerequisite: CSC 349 and either CSC/CPE 357 or CSC/CPE 353.

CPE 431 Programming Languages II (4)  (Also listed as CSC 431)
Language principles and design issues: bindings, conversion, parameter passing, and dynamic semantics. Language implementation: intermediate code representation, memory management, code optimization, and code generation. Functional programming languages. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 430.

CPE 432 Digital Control Systems (3)  (Also listed as EE 432)
Theory and applications of digital computers in linear control systems. Discrete time methods are used in analysis and design studies. Digital control systems are synthesized. 3 lectures. Prerequisite: EE 302K&342 with a C- grade or better. Prior background in discrete time systems, e.g., EE 328, EE368 recommended. Concurrent: CPE 472.

CPE 435 Introduction to Object Oriented Design Using Graphical User Interfaces (4)  (Also listed as CSC 435)
Principles of object-oriented design, with emphasis on use of these principles in the design of graphical interfaces. Comparison and contrasting of two major object-oriented languages and their corresponding GUI class libraries. Language-independent object-oriented design methods, and application of these methods in the construction of a GUI-based project. 3 lectures, 1 laboratory. Prerequisite: CPE 103, with a grade of C- or better, or equivalent and CPE 305.

CPE 437 New course – Effective Spring 2009; see Updates

CPE 438 Digital Computer Systems (3)  (Also listed as EE 438)
Design of computer ALU’s, microprogram controllers, memory systems, and I/O controllers. Use of LSI components in CPU design. Microprogram and nanoprogram development. 3 lectures. Prerequisite: CPE 427 or consent of instructor.

CPE 439 Computer Peripheral Interfacing (4)  (Also listed as EE 439)
Systems-level design and implementation of common computer peripheral devices with emphasis placed on controller and interface aspects. Use of standard and softcore microcontroller platforms with communications to discrete peripherals with I2C, SPI, CAN, and other common bus interfaces. 3 lectures, 1 laboratory. Prerequisite: CPE/EE 329 with a C- grade or better, or consent of instructor.

CPE 448 Bioinformatics Algorithms (4)  (Also listed as CSC 448)
Introduction to the use of computers to solve problems in molecular biology. The algorithms, languages, and databases important in determining and analyzing nucleic and protein sequences and their structure. 3 lectures, 1 laboratory. Prerequisite: Consent of instructor or the following: CSC/CPE 103, with a grade of C- or better, or BIO 447 and senior standing.

CPE 449 Current Topics in Algorithms (4)  (Also listed as CSC 449)
Selected aspects of the verification, analysis and design of algorithms. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC 349.

CPE 450 CPE Capstone Project (4)
Team-based design, construction and deployment of an embedded system that includes a custom-built computer. Technical management of product development teams. Technical documentation, configuration management, quality assurance, integration and systems testing. Professionalism. 3 lectures, 1 laboratory. Prerequisite: CPE 350.
CPE 453 Introduction to Operating Systems (4)
(Also listed as CSC 453)
Introduction to sequential and multiprogramming operating systems; kernel calls, interrupt service mechanisms, scheduling, files and protection mechanisms, conventional machine attributes that apply to operating system implementation, virtual memory management, and I/O control systems. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 305 or both CSC/CPE 315 and CSC/CPE 357.

CPE 454 Implementation of Operating Systems (4)
(Also listed as CSC 454)
Design and implementation of multiprogramming kernels, systems programming methodology, interprocess communications, synchronization, device drivers and network access methods. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 453.

CPE 456 Introduction to Computer Security (4)
(Also listed as CSC 456)
Survey of topics in computer system and network security, including protection, access control, distributed access control, operating system security, applied cryptography, network security, firewalls, secure coding practices, and case studies from real-world systems. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 453 and either CSC 300 or CPE 350.

CPE 458 Current Topics in Computer Systems (4)
(Also listed as CSC 458)
Selected aspects of design, implementation and analysis of networks, advanced operating and distributed systems. Topics may include process management, virtual memory, process communication, context switching, file system designs, persistent objects, process and data migration, load balancing, security and networks. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 453.

CPE 461, 462 Senior Project I, II (3) (2)
Selection and completion of an individual or team project in laboratory environment. Project results are presented in a formal report. CPE 461: 3 laboratories; prerequisite: CPE 350. CPE 462: 2 laboratories; prerequisite: CPE 450.

CPE 464 Introduction to Computer Networks (4)
(Also listed as CSC 464)
Computer network architectures; communications protocol standards; services provided by the network; historical and current examples presented. 3 lectures, 1 laboratory. Prerequisite: STAT 312 or STAT 321 or STAT 350 and either CSC/CPE 357 or CSC/CPE 305.

CPE 465 Advanced Computer Networks (4) (Also listed as CSC 465)
Advanced topics in computer networks; greater detail of protocol standards and services provided by the network; focus on current industry and research topics. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 464 and CSC/CPE 453.

CPE 466 New course – Effective Spring 2009; see Updates

CPE 468 Database Management Systems Implementation (4)
(Also listed as CSC 468)
Data structures and algorithms used in the implementation of database systems. Implementation of data and transaction managers: access methods interfaces, concurrency control and recovery, query processors and optimizers. Introduction to implementation of distributed database systems. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 365.

CPE 469 Distributed Computing II (4) (Also listed as CSC 469)
Continued exploration of topics in distributed computing in greater depth, with emphasis on design patterns and team projects. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 369.

CPE 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Consent of instructor.

CPE 471 Introduction to Computer Graphics (4)
(Also listed as CSC 471)
Graphics software development and use of APIs for 3D graphics. The graphics pipeline, modeling, geometric and viewing transforms, lighting and shading, rendering, interaction techniques and graphics hardware. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 353 or CSC/CPE 357.

CPE 472 Digital Control Systems Laboratory (1)
(Also listed as EE 472)
Design and programming of microprocessor-based digital controls for electro-mechanical plants. Topics include digital control laws, translation of transfer functions into algorithms, assembly language programming, real-time software design, sample rate selection, finite word-length considerations. 1 laboratory. Concurrent: CPE 432.

CPE 473 Advanced Rendering Techniques (4)
(Also listed as CSC 473)
Illumination models, reflectance, absorption, emittance, Gouraud shading, Phong shading, raytracing polyhedra and other modeling primitives, coherence, acceleration methods, radiosity, form factors, advanced algorithms. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471.

CPE 474 Computer Animation (4) (Also listed as CSC 474)
Basic and advanced algorithms for generating sequences of synthetic images. Interpolation in time and space, procedural and keyframe animation, particle systems, dynamics and inverse kinematics, morphing and video. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471.

CPE 476 Real-Time 3D Computer Graphics Software (4)
(Also listed as CSC 476)
Basic and advanced algorithms for real-time, interactive, 3D graphics software. Modeling (polygon mesh, height field, scene graph), real-time rendering and shading (visibility processing, LOD, texture and light maps), collision detection (bounding volumes, complexity management), interactive controls, multi-player game technology, game engine architecture. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471.

CPE 478 Current Topics in Computer Graphics (4)
(Also listed as CSC 478)
Selected aspects of the design, implementation and analysis of computer graphics. Topics may include rendering, modeling, visualization, animation, virtual reality, computer vision, multimedia, and perception issues. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471.

CPE 480 Artificial Intelligence (4) (Also listed as CSC 480)
Programs and techniques that characterize artificial intelligence. Programming in a high level language. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better.

CPE 481 Knowledge Based Systems (4) (Also listed as CSC 481)
In-depth treatment of knowledge representation, utilization and acquisition in a programming environment. Emphasis on the use of domain-specific knowledge to obtain expert performance in programs. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 480.

CPE 482 Advanced Topics in Systems for Computer Engineering (4)
Selected aspects of design, implementation, verification and analysis of advanced computer systems. Topics may include computer systems, embedded systems, robotics, mechatronics, haptics, human computer interfaces, digital control, digital signal processing, wireless computing, real time operating systems, and networks. The Schedule of Classes will list topic selected. Total credit limited to 8 units, repeatable in same term. 3 lectures, 1 laboratory. Prerequisite or concurrent: CPE 350, or consent of instructor.

CPE 483 Current Topics in Human-Computer Interaction (4)
(Also listed as CSC 483)
Selected aspects of the field of human-computer interaction. Topics may include dynamic information visualization, universal access, social impact of technology usage, educational technology, human cognition and performance studies, and extended usability evaluation techniques. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 484.
CPE 484 User-Centered Interface Design and Development (4)  
(Also listed as CSC 484)  
Introduction to the importance of user-centered principles in the design of good interfaces and effective human-computer interaction. Topics include: study of human characteristics affected by interface design, effective requirements data collection and analysis, user-centered approaches to software engineering, and evaluation of interface and interaction quality. 3 lectures, 1 laboratory. Prerequisite: Junior standing and CSC/CPE 307 or software engineering, and evaluation of interface and interaction quality. 3 study of human characteristics affected by interface design, effective cooperative agents, distributed agents, and decision making in complex, graduate standing, or consent of instructor.

CPE 489 Current Topics in Artificial Intelligence (4)  
(Also listed as CSC 489)  
Selected aspects of the design, implementation and analysis of advanced systems and concepts in the area of artificial intelligence. Topics may include knowledge representation, reasoning, learning, or planning, and specific techniques like intelligent agents, genetic algorithms, semantic web, or robotics. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 480.

CPE 493 Cooperative Education Experience (2) (CR/NC)  
Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. Total credit limited to 6 units. Prerequisite: Sophomore standing and consent of instructor.

CPE 494 Cooperative Education Experience (6) (CR/NC)  
Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. Total credit limited to 18 units. Prerequisite: Sophomore standing and consent of instructor.

CPE 495 Cooperative Education Experience (12) (CR/NC)  
Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. Total credit limited to 24 units. Prerequisite: Sophomore standing and consent of instructor.

CPE 520 Computer Architecture (4) (Also listed as CSC 520)  
Comparative study and design of multiprocessor, dataflow, RISC, high level language and other new computer architectures. VLSI processor design techniques. 3 seminars, 1 laboratory. Prerequisite: CPE 315 and graduate standing, or consent of instructor.

CPE 522 New course (crosslisting) – Effective Spring 2009; see Updates

CPE 556 New course – Effective Spring 2009; see Updates

CPE 564 Computer Networks: Research Topics (4)  
(Also listed as CSC 564)  
Exploration of advanced topics in emerging computer networking technologies; focus on leading edge computer network research topics. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 464 and graduate standing, or consent of instructor.

CPE 569 Distributed Computing (4) (Also listed as CSC 569)  
Principles and practices in distributed computing: interprocess communications, group communications, client-server model, distributed objects, message queue system, distributed services, mobile agents, object space, Internet protocols. Distributed algorithms: consensus protocols, global state protocols. Fault tolerance: classification of faults, replication. Not open to students with credit in CSC/CPE 369 or CSC/CPE 469. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357 or CSC/CPE 353 and graduate standing, or consent of instructor.

CPE 580 Artificial Intelligence (4) (Also listed as CSC 580)  
Current research in the field of artificial intelligence with emphasis on cooperative agents, distributed agents, and decision making in complex, concurrent environments. AI programming in a distributed environment. 3 lectures, 1 laboratory. Prerequisite: CPE 481.

CPE 581 Computer Support for Knowledge Management (4)  
(Also listed as CSC 581)  
Use methods and techniques that computer-based systems can provide to make the management of knowledge and information in digital form easier for the user. Emphasis on support for knowledge-intensive activities performed by users. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 481.

CRP–CITY AND REGIONAL PLANNING

CRP 101 Introduction to the Profession of City and Regional Planning (1) (CR/NC)  
Introduction to what professional planners do in the public and private sectors and how they help manage growth and change. Credit/No Credit grading only. 1 lecture.

CRP 201 Basic Graphic Skills (4)  
Basic techniques used in graphic communication for representation of the real world on two-dimensional planes. Use of scale, drawing conventions, orthographic and isometric projections, perspective drawings, sketching, delineation and rendering including the use of black and white and color techniques. 4 laboratories.

CRP 202 Urban Design Studio I (4)  
Exploring elements and principles of environmental design. Understanding the form and character of the designed urban environment. Introduction to problem analysis and problem solving in environmental design. Implications of design decisions and solutions on urban context. Assignments of object, project and system scale in an urban context. 4 laboratories. Prerequisite: CRP 201. Changed effective Winter 2009; see Updates.

CRP 203 Urban Design Studio II (4)  
Applications of basic design fundamentals and skills to the design of environments through design exercises applied to planning. Problem analysis and problem solving skills as applied to environmental design issues. 4 laboratories. Prerequisite: CRP 202.

CRP 211 Cities: Form, Culture and Evolution (4)  
Historical overview of the evolution of cities – how the form and function of cities evolved from different societies from antiquity to contemporary times. Includes early cities in Mesopotamia, Central America; Greece and Rome; Renaissance, Baroque; and North and South America. 4 lectures.

CRP 212 Introduction to Urban Planning (4)  
Understanding the issues of contemporary urban growth and change. Development of theories of urban planning and design. Introduction to zoning, planning regulations and codes, and professional practice. Relationship of environmental design disciplines, citizen groups, and individuals to urban planning. 4 lectures.

CRP 213 Population, Housing and Economic Applications (4)  
Collection, organization, and presentation of information and data related to population, housing and employment. Analytical applications to estimate population over time, housing demand by type and income and employment by standard classification. Application of urban economic theory related to jobs and housing. 4 lectures. Prerequisite: CRP 212, ECON 201 or consent of instructor. Changed effective Fall 2008; see Updates.

CRP 214 Land Use and Transportation Studies (4)  
How cities and regions work. Relationship between human activities and patterns of land use and circulation. Spatial analysis and location theories. Methods for conducting studies to describe, analyze, and map land uses. Regional-scale transportation analysis, traffic impact studies, and multimodal transportation plans. 4 lectures. Prerequisite: CRP 212.

CRP 215 Planning for and with Multiple Publics (4)  
(Also listed as ES 215)  
USCP

How the social/spatial relationships among racial/ethnic and gender groups are expressed in terms of human settlement patterns, civic involvement and everyday negotiations. Ways in which segregation and marginalization are
expressed in western and non-western contexts. 4 lectures. Prerequisite: Completion of GE Area D1.

CRP 216 Computer Applications for Planning (2)
Introduction to the use of computer applications for planners. Includes spreadsheets, statistical applications, database, geographic information systems, and graphics. 1 lecture, 1 laboratory.

CRP 240 Additional Planning Laboratory (1–2)
Total credit limited to 4 units, with a maximum of 2 units per quarter. 1 or 2 laboratories.

CRP 310 Community Development and Civic Life (4)
Examination of role of citizen in the planning, design and development of communities. Development of informed, responsible participation in civic life by a diverse citizenry committed to democratic principles. Focus on land use, transportation, and environmental issues. 4 lectures. Prerequisite: Completion of GE Areas A, D1 and D3.

CRP 314 Planning Theory (3)
Theories of planning. Role of planner in society, purpose of planning, administrative framework in which planning takes place. Alternative approaches to planning, values, ethics in planning. 3 lectures. Prerequisite: CRP 212.

CRP 315 Fiscal and Project Feasibility (4) (Also listed as CM 315)
Analysis of the revenue streams and costs involved in project development. Impact analysis of costs and revenues on private and public sectors included. Construction of pro-formas for various project types. 3 lectures, 1 laboratory. Prerequisite: Completion of GE Area D2.

CRP 334 Cities in a Global World (4)
Examination of the changes in the social and spatial organization of urban settlements in the twenty-first century caused by the urbanization and globalization processes. Comparative analysis of the traditional and contemporary cities in the Pacific Rim, South America and Eastern Europe. 4 lectures. Prerequisite: Completion of Area A and two courses from D1, D2, D3, D4. City and Regional Planning majors will not receive GE Area D5 credit.

CRP 336 Introduction to Environmental Planning (4)
Theories, institutional frameworks, and technologies used in environmental planning for human settlements. Comparative study of practices at international, national, bioregional and state/local levels. Impact assessment technologies used in impact analysis for plan administration. Application of environmental mitigation to community planning. 4 lectures. Prerequisite: CRP 212.

CRP 338 Digital Cities (4)
GE Area F
Explores changes in urban form and urban experience associated with advances in digital technology. Implications for the design of places and the distribution of economic and social benefit. Lecture-discussions and opportunities to explore technology initiatives in community building. 4 lectures. Prerequisite: Junior standing; completion of Area B.

CRP 341 Community Design Laboratory (4)
Built environment of the suburb. Urban theories and design methods related to suburban development. Technical aspects of subdivision site planning. 4 laboratories. Prerequisite: CRP 203, or consent of instructor.

CRP 342 Environmental Planning Methods (4)
Case studies and applications of theory and methods to regional and environmental systems. Interrelationships between natural, economic, and social and political systems. Application of California Environmental Quality Act and environmental impact assessment methods. Environmental equity and sustainable bioregions. 2 lectures, 2 laboratories. Prerequisite: CRP 336 or consent of instructor.

CRP 375 Technology and the Environment: A Seminar on Contemporary Issues (4) (Also listed as HNRS 375)
Interdisciplinary exploration of significant environmental issues (local, regional, national, or global) where technology is a major cause and/or offers a possible solution. 4 seminars. Prerequisite: Completion of GE Area A and two courses from Areas D1, D2, D3. Honors Program membership or nomination by CRP department head.

CRP 400 Special Problems for Advanced Undergraduates (1–2)
Individual or group investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of instructor.

CRP 402 Contemporary Urban Design in the Americas (4)
Study of contemporary urban design in North, Central and South America through the detailed examination of major cities and country case studies. Analysis of the cultural, social and political factors influencing the practice of urban design and its major trends in different countries. 4 lectures. Prerequisite: ENGL 134.

CRP 404 Environmental Law (3) (Also listed as FNR 404)
Analysis and critique of the law governing use and protection of natural resources with focus on the legal institutions entrusted with the public duty of protecting the environment. 3 lectures. Prerequisite: Senior standing, or consent of instructor. Changed effective Fall 2008; see Updates.

CRP 408 Water Resource Law and Policy (3) (Also listed as FNR 408)
Detailed examinations of the various legal systems of water use, regulation and management in California and the United States. Discussion of the key concepts and principles of state, federal and interstate water quantity and quality control; focusing on issues and problems, why conflicts occur and how solutions evolve. 3 lectures. Prerequisite: FNR 302 or instructor approval, senior standing. Changed effective Fall 2008; see Updates.

CRP 409 Planning Internship (2–4) (CR/NC)
Work experience as a supervised employee in a planning-related agency or private firm. Prior contract specifying the product of internship required between student, agency and faculty. Thirty hours work experience per unit of credit. Total credit limited to 4 units. Credit/No Credit grading. Prerequisite: Consent of instructor.

CRP 410, 411 Community Planning Laboratory I, II (5) (5)
Application of planning theory to the community, its components, and to the city and its region. Relationships of city spaces and structures. Emphasis on developing basic planning studies and plan-making. Field trips. Individual, team, and interdisciplinary approaches utilizing digital methods for analysis and presentation. 5 laboratories. CRP 410 prerequisite: LA 213, CRP 203, CRP 213, CRP 214, CRP 336, CRP 341 or consent of instructor. CRP 411 prerequisite: CRP 342, CRP 410, or consent of instructor. Changed effective Fall 2008; see Updates.

CRP 412 Plan Implementation (4)
Theory and practice of plan implementation. Regulation and nonregulatory approaches to plan implementation, including development regulation, economic development, growth management, habitat conservation planning, capital improvement planning, redevelopment programs, and transportation system management. The California Specific Plan will serve as the course model. 4 lectures. Prerequisite: CRP 212 and third-year standing, or consent of instructor.

CRP 420 Land Use Law (4)
Public controls protecting natural environmental systems. Land use and environmental controls. Review of control mechanisms. State and federal legislation. Legal implications of controls, public planning and policy issues. 4 lectures. Prerequisite: senior standing, or consent of instructor.

CRP 427 Local Economic Development Planning (3)
Processes, skills and approaches for planning local economic development. Analysis of theoretical principles and assumptions underlying local economic development programs. Practical applications of alternative strategies and techniques for implementing economic development. 3 seminars. Prerequisite: Senior standing or consent of instructor.

CRP 430 Public Sector Planning Practice (3)
Relationships of planning agencies to other governmental bodies, public agencies and citizen groups. The public planning agency and the private practitioner. Public and personnel relations. Current topics in public sector planning practice. 3 lectures. Prerequisite: CRP 212.
CRP 435 Transportation Theory (3)
Circulation and transportation elements of the General Plan. Transportation planning theory, methods and tools related to systematic analysis of city and regional transportation problems including environmental impact assessment. Application of techniques for assessing transportation systems, gravity models, route selections, land use models and relationship to transportation. 3 seminars. Prerequisite: CRP 212, senior standing or consent of instructor. Changed effective Fall 2008; see Updates.

CRP 436 Collaborative Planning (4)
Focus on processes and skills of citizen participation and consensus building. Application of mediation and negotiation techniques. Use of collaboration in forming visions of the future and reaching agreements among multiple interests. Use of group process skills to establish effective communication and agreements. Organizing and operating public meetings. 3 lectures, 1 laboratory. Prerequisite: CRP 212 or graduate standing or consent of instructor.

CRP 438 Pollution Prevention and Control (4)
Interdisciplinary exploration of policy and planning associated with pollution prevention and control, including institutional, legal, economic, political, social, and technology-related aspects. Includes hands-on activity in small groups. 4 lectures. Prerequisite: Senior standing or consent of instructor. Changed effective Spring 2009; see Updates.

CRP 442 Housing and Planning (3)
Understanding housing issues, policies and programs from a planning perspective. Analysis of the economic underpinnings of land markets and housing markets, housing plans, finance, public programs, affordable housing. 3 seminars. Prerequisite: Upper division standing. Changed effective Winter 2009; see Updates.

CRP 444 Infrastructure and Planning Management (4)
Basic infrastructure systems necessary to support urban development. Basic components of systems and how they are planned, financed and managed. 4 seminars. Prerequisite: Senior standing.

CRP 446 Development Review and Entitlement (4)
Application of zoning regulations, subdivision ordinances, design standards, building codes, exactions, fees, and related requirements within the development review process leading to land use entitlement. Development is evaluated from permit application submittal to condition compliance during the plan check, construction, and operational phases of a project. 4 lectures. Prerequisite: Upper division standing. Changed effective Winter 2009; see Updates.

CRP 447 Design Regulations (4) (Also listed as ARCH 447)
Practical application of fundamental zoning, subdivision, design-development standards, and building codes in the design review process, either in the form of a proposed development project or preparation of ordinances, codes, standards, and/or guidelines to apply to a project. 4 lectures. Prerequisite: Fourth year standing, or consent of instructor.

CRP 452 New course – Effective Winter 2009; see Updates

CRP 453 Planning and Design Laboratory (4)
Selected advanced laboratory applications, including urban and regional design. 4 laboratories. Prerequisite: CRP 341, CRP 342.

CRP 457 Planning Information Systems (3)
GIS applications using computer-based systems in gathering, managing and analyzing information pertinent to planning. Development of skills in systematic data acquisition, processing and maintenance with applied planning problems within the convenient medium of GIS and general information systems. 2 seminars, 1 laboratory. Prerequisite: Upper-division standing and completion of a basic GIS course (FNR 318, GEOG 310, or LA 318), and consent of instructor.

CRP 458 Local Hazard Mitigation Planning and Design (4)
Creation of safer, more resilient cities through systematic application of urban disaster risk reduction and regeneration planning principles and methods. Integration of insights from the design, resource management, and urban administration professions for minimizing disaster losses and improving recovery activities. 4 lectures. Consent of instructor. Prerequisite: GE Areas D2, D3 and F or consent of instructor.

CRP 461, 462 Senior Project I, II (2) (2)
Research and problem analysis in planning. Selection and completion of a project under faculty supervision. Projects typical of problems addressed in planning practice. Project results presented in a formal report. To be completed in two quarters. Minimum 120 hours time. Prerequisite: CRP 341, CRP 342. Changed effective Fall 2008; see Updates.

CRP 463 Senior Project Professional Practice (4)
Practical applications of city and regional planning theory and practice solving problems related to the built environment. Assembly of project documents and reports that meet the senior project requirement. 4 seminars. Prerequisite: CRP 410 and senior standing.

CRP 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Consent of instructor.

CRP 471 Selected Advanced Laboratory (1–4)
Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1–4 laboratories. Prerequisite: Consent of instructor.

CRP 472 Planning Colloquium (1) (CR/NC)
Lecture and discussion by faculty members and invited guests on controversial or topical planning related subject matter at campus and/or off-campus locations. Topics to be announced in advance by CRP Department. Total credit limited to 3 units. Credit/No Credit grading only. 1 seminar. Prerequisite: Upper division standing.

CRP 483 Special Studies in City and Regional Planning (1–12)
Study of special issues and problems through field research and other forms of investigation and involvement in an off-campus setting. Requirements determined prior to individual project through contractual arrangement between the student and the department. Departmental Off-Campus Study Program guidelines apply. The Schedule of Classes will list topic selected. Prerequisite: Junior standing.

CRP 500 Individual Study (2–3)
Independent research, studies, or surveys of selected subjects. Total credit limited to 9 units. Prerequisite: Graduate standing with minimum of 12 core units.

CRP 501 Foundations of Cities and Planning (4)
Origins and evolutionary stages of settlement patterns and the use of land and natural environment. Changing spatial structure in the development of cities and regions. Beginnings and the historical development of the planning profession. 4 lectures. Prerequisite: Graduate standing.

CRP 505 Principles of Regional Planning (4)
History, development and major philosophical approaches of regions and regional planning, both in urban-centered and resource-based regions. Effects of relaxing natural, economic and infrastructure limiting factors on growth and development of regions. Normative hierarchical emphasis of contemporary regional planning compared to emerging paradigms that alter the regional/local planning relationship. 4 seminars. Prerequisite: Graduate standing or consent of instructor.

CRP 510 Planning Theory (4)
Theory of planning. Development of contemporary planning thought from varying sources and perspectives. Political and social context of planning. Alternative professional roles, and planning processes. Values and ethical issues in planning. 4 seminars. Prerequisite: Graduate standing or consent of instructor.

CRP 512 Introduction to Visual Communication and GIS (4) (CR/NC)
Introduction to geographic information systems (GIS) as a tool for analyzing and managing spatial information pertinent to planning. Introduction to various drawing media and delineation techniques for planners, including three-dimensional visualization and graphic skills.
Integration of visual and digital media in presentations. Credit/No Credit grading only. 4 laboratories. Prerequisite: Graduate standing.

**CRP 513 Planning Research Methods (4)**

Application of research design to planning issues. Comparison of case study, comparative and problem-solving methods. Primary and secondary data sources, including field survey techniques. 3 seminars and supervised work. Prerequisite: Graduate standing, STAT 221 or equivalent, or consent of instructor.

**CRP 514 Computer Applications for M.C.R.P. (2)**

Microcomputer applications used by planners. Focus on planners' adaptations of spreadsheets, statistical applications, data base systems, graphic presentation. 2 laboratories. Prerequisite: Graduate standing.

**CRP 515 Planning Presentation and Communication Techniques (3)**

Basic techniques used in effective planning presentations. Introduction to various drawing media and delineation techniques for planners, three-dimensional visualization, graphic skills. Integration of visual and electronic media in presentations. 3 laboratories. Prerequisite: Graduate standing.

**CRP 516 Methods of Data Analysis (4)**

Problem recognition, data selection, analysis and synthesis with applications of system design, statistical techniques and symbolic modeling to urban design and regional growth and development policies. 3 seminars, 1 laboratory. Prerequisite: Graduate standing or consent of instructor.

**CRP 518 Public Policy Analysis (4)**

Analysis of the social, economic, environmental, political contexts of public policy decisions. Public policy issues and use of concepts and tools related to monitoring and assessment. 4 lectures. Prerequisite: CRP 501 or POLS 360 or consent of instructor.

**CRP 520 Feasibility Studies in Planning (4)**

Fundamental analysis for assessing feasibility of public and private development projects. Principles and techniques for analyzing markets and assessing cash flow for individual projects. Economic, fiscal and tax impacts as factors determining public participation in private projects. 4 seminars. Prerequisite: CRP 501 or consent of instructor.

**CRP 525 Plan Implementation (4)**

Theory and practice of plan implementation. Regulatory and non-regulatory frameworks for plan implementation. Growth management, development regulation, capital improvement programs, redevelopers. 4 seminars. Prerequisite: Graduate standing or consent of instructor.

**CRP 530 Planning Agency Management (3)**

Preparation for mid-level and higher positions in public planning agencies and private firms. Applications of organization theory to planning agencies and firms. Work programs, staff development, budgets, contracting, proposal preparation, conflict management. Relationships with other agencies and firms, clients, public and media. 3 seminars. Prerequisite: CRP 501, CRP 510 or consent of instructor.

**CRP 535 Land Use and Planning Law (4)**

The role of law in the planning and regulation of land use. Constitutional constraints on land use regulation. Legal and policy issues for environmental protection and public administration. Relevant legislation and case law. 4 lectures. Prerequisite: Graduate standing, or consent of instructor.

**CRP 545 Principles of Environmental Planning (4)**

Environmental planning as a field of inquiry and action. Review and application of policies and techniques used in environmental planning, especially within the land use planning context. Application of California Environmental Quality Act and environmental impact assessment methods. 3 seminars, 1 laboratory. Prerequisite: Graduate standing or consent of instructor.

**CRP 548 Principles of Urban Development and Design (4)**

Introduction to the philosophy and theory particular to urban development and design. Exploration of evaluation criteria and critical analysis of the human environment related to physical design requirements. Spatial and form relationships, scale, human activities, concept formation, visual organization of the city, landscaping and architecture. 4 seminars. Prerequisite: Graduate standing or consent of instructor.

**CRP 552 Community and Regional Planning Studio I (4)**

Application of planning theory and methods to community and regional planning projects. Structured for research, analysis, synthesis, and implementation practice. Interrelationships of natural and built environments, transportation systems, and economic and social conditions at various planning scales. Includes field trips and individual, team and interdisciplinary approaches. 2 seminars, 2 laboratories. Prerequisite: CRP 501, CRP 525, or consent of instructor.

**CRP 553 Project Planning Laboratory (4)**

Project-scale planning problems. Arranging structures, circulation systems, utilities and plant material on natural and urban sites to support human activity while minimizing disruption to natural systems. Includes planned unit developments, waterfronts, hillside, campuses and commercial centers. Field trips. 2 lectures, 2 laboratories. Prerequisite: CRP 512 or consent of instructor. Changed effective Spring 2009: see Updates.

**CRP 554 Community and Regional Planning Studio II (4)**

Application of planning theory and methods to community and regional planning projects. Structured for research, analysis, synthesis, and implementation practice. Interrelationships of natural and built environments, transportation systems, and economic and social conditions at various planning scales. Includes field trips, and individual, team and interdisciplinary approaches. 2 seminars, 2 laboratories. Prerequisite: CRP 552.

**CRP 556 Community and Regional Planning Studio III (4)**

Application of planning theory and methods to community and regional planning projects. Individual faculty-assigned laboratory work leading to the completion of a professional quality project focused on a real-world planning task. Structured for research, analysis, synthesis and implementation practice. 3 seminars and supervised work. Prerequisite: CRP 554, or consent of instructor.

**CRP 570 Selected Topics in Planning (4)**

Directed group study of selected planning topics. Total credit limited to 12 units. 4 seminars. Prerequisite: Graduate standing or consent of instructor.

**CRP 596 Professional Project (2-4)**

Individual research under the supervision of the faculty, leading to completion of a professional project based on a real world planning task or carefully constructed simulation. Must be taken in all quarters requiring supervision; minimum of 6 units required for degree. Total credit limited to 8 units. Prerequisite: CRP 513, and consent of the graduate program coordinator.

**CRP 597 Policy, Planning and Management (4)**

This course provides a synthesis of the MCRP program. Expansion and integration of material on planning principles, practice, theory and quantitative methods. 4 seminars. Prerequisite: CRP 409, CRP 510, CRP 516, CRP 518, CRP 525, CRP 530, CRP 535, CRP 552 and CRP 554.

**CRP 599 Thesis (2-4)**

Individual research under the general supervision of the faculty, leading to a graduate thesis. Must be taken in all quarters requiring supervision; minimum of 6 units required for degree. Total credit limited to 8 units. Prerequisite: CRP 513, and consent of the graduate program coordinator.

**CRSC–CROP SCIENCE**

**CRSC 123 Forage Crops (4)**

CRSC 132 California Field Crops (4)
Production, adaptation, distribution, and utilization of five economically significant field crops: alfalfa, corn, cotton, potatoes, and rice. Field trips to production areas. 3 lectures, 1 laboratory. Prerequisite: HCS 120.

CRSC 202 Enterprise Project (2–4) (CR/NC)
Beginning field experience in production and marketing of an agronomic crop, under faculty supervision. Project participation is subject to approval by the department head and the Cal Poly Corporation. Degree credit limited to 4 units. Credit/No Credit grading only. 1 lecture, variable practicum.

CRSC 203 Organic Farming Enterprise Project (2-4) (CR/NC)
Beginning field experience in production and marketing of organic vegetable and fruit crops, under faculty supervision. Project participation subject to approval by department head and Cal Poly Corporation. Degree credit limited to 4 units. 2-4 units of independent study. Credit/No Credit grading only.

CRSC 244 Precision Farming (4)
Precision agriculture applications. Integrating GIS, GPS, and remote sensing technologies with site-specific farming practices to optimize agricultural productivity. Field trip required. 3 lectures, 1 laboratory. Prerequisite: HCS 120 or other 100-200 level CRSC/FRSC/HCS/VGSC course.

CRSC 333 Greenhouse Vegetable Production (4)
Development, practices, history, and future of crop production in greenhouses. Research applications, commercial applications, production problems, marketing, and economics. Special emphasis on growing transplants in greenhouses and use of nutrient solutions. Field trips to a commercial greenhouse operation and/or analysis lab required. 3 lectures, 1 laboratory. Prerequisite: CHEM 111, SS 221, VGSC 190 or consent of instructor. Students cannot receive degree credit in both CRSC 333 and EHS 140.

CRSC 402 Enterprise Project Management (2–4) (CR/NC)
Advanced experience in production of an agronomic crop. Development of a plan for field operations, a marketing plan, and a budget. Management decision-making. Project participation is subject to approval by the department head and the Cal Poly Corporation. Degree credit limited to 4 units. Credit/No Credit grading only. 1 lecture, variable practicum. Prerequisite: CRSC 202, and consent of instructor.

CRSC 411 Experimental Techniques and Analysis (4)
Principal experimental designs used in agriculture and methods of statistical analysis of data collected from each. Statistical software. Field practice in planning and layout of typical experiments. 3 lectures, 1 laboratory. Prerequisite: Junior standing and MATH 118 or equivalent, and STAT 218 or consent of instructor.

CRSC 421 Oil and Fiber Crops (4)
Culture, harvest, grading, and marketing of cotton, soybean, sunflower, safflower, and other oil and fiber crops. Field trips to major centers of production and marketing required. 3 lectures, 1 laboratory. Prerequisite: CRSC 132, PPSC 321 and BOT 121.

CRSC 422 Tropical and Subtropical Crop and Fruit Production (4)
(Also listed as FRSC 422)
Production, distribution and utilization of major agronomic, vegetable, fruit and nut crops of economic importance in tropical and subtropical areas. Weather systems, climates, soils, and cropping systems of tropical and subtropical areas. Field trip required. 3 lectures, 1 laboratory. Prerequisite: 100/200-level plant production course, or consent of instructor.

CRSC 445 Cropping Systems (4)
Classification and description of agricultural systems of the world. Cropping systems as land management plans. Systems approaches to improvement of agricultural situations. Consideration of human factors and the agroecosystem in efforts to create a more sustainable agriculture. Field trip required. 3 lectures, 1 activity. Prerequisite: SS 121 and BOT 121, or HCS 120, or BOT 326, or consent of instructor.

CRSC 581 Graduate Seminar in Crop/Fruit Production (3)
Group study of current problems, trends and research results pertaining to production or marketing of field, vegetable or fruit crops. 3 seminars. Prerequisite: Graduate standing.

CRSC 599 Thesis in Crop Science (1–9)
Systematic research of a significant problem in Crop Science. Thesis will include problem identification, significance, methods, data analysis, and conclusion. Students must enroll every quarter in which facilities are used or advisement is received. Degree credit limited to 6 units. Prerequisite: Graduate standing and consent of instructor.

CSC–COMPUTER SCIENCE

CSC 100 Computer Science Orientation (2)
Introduction to the computer science discipline for majors. Computer problem solving and the use of computers. Success skills for computer science majors. Career paths and opportunities. Interaction with upper division students and faculty. 2 seminars. Prerequisite: Computer science major or minor or software engineering major.

CSC 101 Fundamentals of Computer Science I (4)
(Also listed as CPE 101)
Basic principles of algorithmic problem solving and programming using methods of top-down design, stepwise refinement and procedural abstraction. Basic control structures, data types, and input/output. Introduction to the software development process: design, implementation, testing and documentation. The syntax and semantics of a modern programming language. Credit not available for students who have taken CSC/CPE 108. 3 lectures, 1 laboratory. Prerequisite: MATH 118 (or equivalent) with a grade of C- or better, and basic computer literacy (CSC 100 or CSC 232 or equivalent).

CSC 102 Fundamentals of Computer Science II (4)
(Also listed as CPE 102)
Basic design, implementation, testing, and documentation of object-oriented software. Introduction to classes, interfaces, inheritance, algorithms (sort, search, recursion), abstract data types, data structures (lists, stacks, queues), file I/O, and exceptions. Credit not available for students who have taken CSC/CPE 108. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 101 with a C- grade or better and either MATH 141 or MATH 221 with a C- grade or better. Corequisite: CSC 141.

CSC 103 Fundamentals of Computer Science III (4)
(Also listed as CPE 103)
Introduction to data structures and analysis of algorithms. Abstract data types. Specification and implementation of advanced data structures. Theoretical and empirical analysis and proofs of properties of recursive and iterative algorithms. Software performance evaluation and testing techniques. 3 lectures, 1 laboratory. Prerequisite: CPE 102 with a C- grade or better and CSC 141 with a C- grade or better.

CSC 108 Accelerated Introduction to Computer Science (4)
(Also listed as CPE 108)
Accelerated introduction to basic principles of algorithmic and object-oriented problem solving and programming. Introduction to programming language concepts including control structures, data types, classes, and inheritance. Program design principles. Use and implementation of algorithms (searching, sorting, recursion) and data structures (lists, stacks, and queues). Intended for students with experience in algorithmic problem solving and using basic control structures and data types in a modern programming language (CSC/CPE 101), but who are not ready for CSC/CPE 102. Credit not available for students who have taken CSC/CPE 102. 3 lectures, 1 laboratory. Prerequisite: Math 118 (or equivalent) with a grade of C- or better, significant experience in computer programming, and consent of instructor. Corequisite: CSC 141.

CSC 110 Computers and Computer Applications: Windows (3)
The computer as a problem-solving tool. A working introduction to microcomputers and fundamental computer concepts. Use of applications software. Credit not allowed for CSC or Software Engineering majors. 2
lectures, 1 activity. Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

CSC 113 Computers and Computer Applications: Macintosh (3)
The computer as a problem-solving tool. A working introduction to microcomputers and fundamental computer concepts. Use of applications software. Credit not allowed for CSC or Software Engineering majors. 2 lectures, 1 activity. Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

CSC 119 Information Retrieval and Management (4)
Use of applications software, including database software, to create and manage information. Credit not allowed for CSC or Software Engineering majors. 4 lectures. Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

CSC 141 Discrete Structures I (4)
Introduction to structures of computer science: logic, sets, relations, functions, graphs and trees. Propositional and predicate logic. Applications of predicate logic to preconditions, postconditions, and proof techniques. Introduction to complexity of algorithms. 4 lectures. Corequisite: CSC/CPE 102. Prerequisite: MATH 118 and MATH 119, or high school equivalent, and CSC/CPE 101 or equivalent.

CSC 142 Discrete Structures II (4)

CSC 200 Special Problems for Undergraduates (1–2)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of instructor.

CSC 225 Introduction to Computer Organization (4)
Introduction to computer systems. Simple instruction set architecture and the computer hardware needed to implement that architecture. Machine and assembly language programming. 3 lectures, 1 laboratory. Prerequisite: CPE 129&169; CSC/CPE 102.

CSC 231 Programming for Engineering Students (2)
Programming techniques and procedures with applications to engineering problems. Introduction to numerical methods and simulation. Credit not allowed for CSC, Software Engineering or CPE majors. 2 activities. Prerequisite: MATH 142 or MATH 132; PHYS 121 or PHYS 131.

CSC 232 Computer Programming for Scientists and Engineers (3)
Computer programming, with an emphasis on procedural programming, taught using a language hosted by applications commonly used in science and engineering. Credit not allowed for CSC, CPE or Software Engineering majors. 2 lectures, 1 activity. Prerequisite: MATH 118 or equivalent.

CSC 234 C and Unix (3)
The C programming language and the UNIX programming environment. Operators, standard I/O functions, strings, pointers and arrays, data types and storage classes. Unix shell programming and basic I/O system calls. Credit not allowed for CSC, Software Engineering or CPE majors. 3 lectures. Prerequisite: MATH 142 or MATH 132.

CSC 235 Fundamentals of Computer Science for Scientists and Engineers I (4) (Also listed as CPE 235)
Introduction to the fundamentals of computer programming with an emphasis on mathematical, scientific and engineering applications: principles of algorithmic problem solving and procedural programming using a modern programming language, data types, elementary data structures, input/output and control structures. Not a substitute for CSC/CPE 101 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: MATH 141 or MATH 161 with a grade of C- or better, or consent of instructor.

CSC 236 Fundamentals of Computer Science for Scientists and Engineers II (4) (Also listed as CPE 236)
Further study of computer program development with an emphasis on mathematical, scientific and engineering applications. Introduction to more complicated data types and structures. Practice of more complicated techniques of procedural programming. Introduction to the principles of object-oriented programming using a modern programming language. Detailed discussion of lists and classic list algorithms, algorithm analysis, multidimensional arrays, records, dynamic data structures, file input/output, classes. Not a substitute for CSC/CPE 102 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 235 with a grade of C- or better, or consent of instructor.

CSC 237 Introduction to Computer Science with Applications I (4)
(Also listed as CPE 237)
Introduction to the fundamentals of computer science using a modern programming language. Includes principles of algorithmic problem solving, data types, elementary data structures, input/output, control structures, classes and methods. Not a substitute for CSC/CPE 101 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 235 with a grade of C- or better, or consent of instructor.

CSC 238 Introduction to Computer Science with Applications II (4)
(Also listed as CPE 238)
Continuation of CSC 237. Intermediate study of computer program development using a modern object oriented (OO) programming language. Further study of OO principles including inheritance and interfaces. Introduction to implementation of Graphical User Interfaces, multi-media, streams, database connection, and scripting. Not a substitute for CSC 102 or for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 237 with a grade of C- or better.

CSC 239 Selected Programming Languages (4)
A programming language selected from languages of current interest. Intended for students who want to learn another programming language. The Schedule of Classes will list selected language. 3 lectures, 1 laboratory. Prerequisite: Knowledge of a programming language.

CSC 270 Computer Graphics Applications (4)
(Also listed as CPE 270)
Use of common graphics applications packages. Business graphics, figure editing, animation and image editing, photorealistic image generation, scientific visualization and multimedia. 2 lectures, 2 activities.

CSC 300 Professional Responsibilities (4) (Also listed as CPE 300)
The responsibilities of the computer science professional. The ethics of science and the IEEE/ACM Software Engineering Code of Ethics. Quality tradeoffs, software system safety, intellectual property, history of computing and the social implications of computers in the modern world. Applications to ethical dilemmas in computing. Technical presentation methods and practice. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 307 or CSC/CPE 309.

CSC 302 Computers and Society (4) GE Area F
Social, ethical, political and technological implications and effects of computers in the modern world. Examination of the benefits and side-effects of computer applications and automation. Case study review and analysis. 4 lectures. Prerequisite: Completion of GE Area B, and junior standing.

CSC 303 Teaching Computer Science (2)
Practical coverage of educational techniques appropriate for tutoring in CSC/CPE undergraduate courses, including Socratic methods for tutoring of technical topics, design of test questions and grading rubrics, and lecture presentation. Intended for CSC/CPE/SE students interested in tutoring, grading, or a career in teaching computer science. 1 lecture, 1 laboratory. Prerequisite: CSC/CPE 103, with a grade of C- or better, or equivalent. Not available for technical elective credit.

CSC 305 Individual Software Design and Development (4)
(Also listed as CPE 305)
Practical software development skills needed for construction of mid-sized production-quality software modules, using the CSC upper division...
programming language. Topics include inheritance, exceptions, and memory and disk-based dynamic data structures. Students must complete an individual programming project of mid-level complexity. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 353 or CSC/CPE 357.

CSC 307 Introduction to Software Engineering (4)  
(Also listed as CPE 307)  
Requirements, specification, design, implementation, testing and verification of large software systems. Study and use of the software process and software engineering methodologies; working in project teams. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better, and CSC/CPE 357. Not open to students with credit in CSC/CPE 308.

CSC 308 Software Engineering I (4)  
(Also listed as CPE 308)  
Principles for engineering requirements analysis and design of large complex software systems. Software process models. Methods of project planning, tracking, documentation, communication, and quality assurance. Analysis of engineering tradeoffs. Group laboratory project. Technical oral and written presentations. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better, and CSC/CPE 357 or CSC/CPE 355.

CSC 309 Software Engineering II (4)  
(Also listed as CPE 309)  
Continuation of the software lifecycle. Methods and tools for the implementation, integration, testing and maintenance of large software systems. Software development and test environments. Software quality assurance. Group laboratory project. Technical presentation methods and practice. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 308.

CSC 310 Computers for Poets (4)  
GE Area F  
How computers and computer devices work. Introduction to software systems and applications. How computers connect with various media including images, speech and data. How information is encoded and transmitted across networks. Relationship between the computer and human information processing. 4 lectures. Prerequisite: Junior standing and completion of GE Area B. Changed effective Winter 2008; see Updates.

CSC 315 Computer Architecture (4)  
(Also listed as CPE 315)  
In-depth study of the instruction set architecture and hardware design of a specific CPU. Introduction to pipelines, input/output and multi-processors. Computer abstractions and performance measurement. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 and either CPE/EE 229 or CSC 225.

CSC 316 Micro Controllers and Embedded Applications (4)  
(Also listed as CPE 316)  
Introduction to micro controllers and their applications as embedded devices. Hardware/software tradeoffs, micro controller selection, use of on-chip peripherals, interrupt driven real-time operation, A/D conversion, serial and parallel communications, watch-dog timers, low power operation and assembly language programming techniques. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 315 or CPE/EE 329.

CSC 334 Advanced Topics in Unix (4)  
Advanced topics in Unix, system calls, library functions, shell scripts, and selected Unix tools. 4 lectures. Prerequisite: CSC/CPE 103, with a grade of C- or better, or CSC 234.

CSC 341 Numerical Engineering Analysis (4)  
GE B6  
An intensive survey of numerical analysis techniques used for solving engineering problems. Topics include solution of nonlinear equations, solution of linear systems, interpolation, numerical quadrature, ordinary differential equations and boundary value problems. Not open to students who have completed CSC 342. 4 lectures. Prerequisite: MATH 242 and knowledge of a high level programming language, or ability to use one of the following systems: Maple, Matlab, Mathematica, or Mathcad. Changed effective Spring 2009; see Updates.

CSC 342 Numerical Analysis I (3)  
Computer solutions of nonlinear equations and systems of linear equations. Polynomial interpolation. Numerical quadrature. Introduction to the solution of ordinary differential equations. 3 lectures. Prerequisite: MATH 143 and knowledge of a high level programming language, or ability to use one of the following systems: Maple, Matlab, Mathematica, or Mathcad.

CSC 343 Numerical Analysis II (3)  
Solution of systems of differential equations, predictor-corrector methods, stiff equations. Approximation methods: cubic splines, B-splines, Bezier curves, least squares, methods for solving boundary value problems. 3 lectures. Prerequisite: CSC 342 or equivalent.

CSC 349 Design and Analysis of Algorithms (4)  
Intermediate and advanced algorithms and their analysis. Mathematical, geometrical, and graph algorithms. NP-complete problems. Additional topics will be chosen from pattern matching, file compression, cryptology, dynamic and linear programming, and exhaustive search. 4 lectures. Prerequisite: CSC/CPE 103, with a grade of C- or better, and MATH 142 and either STAT 312 or STAT 321.

CSC 353 Systems Programming for Software Engineers (4)  
(Also listed as CPE 353)  
Assembly language and C programming; I/O and systems level programming; interrupt handlers. Technical elective credit not allowed for CSC/CPE majors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better.

CSC 357 Systems Programming (4)  
(Also listed as CPE 357)  
C programming language from a system programming perspective. Standard C language including operators, I/O functions, and data types in the context of system functions. Unix commands, shell scripting, file system, editors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better, and either CSC 225 or CSC/CPE 229.

CSC 358 Computer System Administration (2)  
Fundamental concepts of Unix system administration. Use of shell scripts and utilities. Techniques of networks and data communications. Methods of system maintenance and accounting. 2 seminars. Prerequisite: CSC/CPE 103 or permission of instructor.

CSC 361 File Structures (4)  
External storage devices. Character, record, and block I/O. Blocking and buffering. File structures: sequential, indexed sequential, B trees, hashing, multi-key and linked. Primary and secondary indexing. Design and implementation of record and object storage managers. Data compression. Multi-media file formats. 4 lectures. Prerequisite: CSC/CPE 103, with a grade of C- or better.

CSC 365 Introduction to Database Systems (4)  
(Also listed as CPE 365)  
Basic principles of database management systems (DBMS) and of DBMS application development. DBMS objectives, systems architecture, database models with emphasis on Entity-Relationship and Relational models, data definition and manipulation languages, the Structured Query Language (SQL), database design, application development tools. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103.

CSC 366 Database Modeling, Design and Implementation (4)  
(Also listed as CPE 366)  

CSC 369 Distributed Computing I (4)  
(Also listed as CPE 369)  
Introduction to distributed computing paradigms and protocols: interprocess communications, group communications, the client-server model, distributed objects, and Internet protocols. Emphasis on distributed software above the operating system and network layers. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357 or CSC/CPE 353.

CSC 400 Special Problems for Advanced Undergraduates (1–2)  
Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of instructor.
Prerequisite: CSC/CPE 307 or CSC/CPE 309; CSC/CPE 305.

CSC 405 Software Construction (4)  (Also listed as CPE 405)
Design and construction of sizeable software products. Technical management of software development teams. Software development processes, software design, documentation, quality assurance during development, software unit and integration testing; CASE tools, development environments, test tools, configuration management. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 402.

CSC 406 Software Deployment (4)  (Also listed as CPE 406)
Deployment of a sizeable software product by a student team. Software maintenance and deployment economic issues. Management of deployed software: version control, defect tracking and technical support. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 405.

CSC 409 Current Topics in Software Engineering (4)  (Also listed as CPE 409)
Selected topics in software engineering. Topics may include program generation, quality assurance, formal methods, software metrics, design methods, testing, or software development processes. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 309 or CSC/CPE 307.

CSC 416 Autonomous Mobile Robotics (4)  (Also listed as CPE 416)
Theory and application of concepts relevant to autonomous mobile robots. Sensor and actuator interfacing, programming mobile robots, mobile robot configurations, software architectures and algorithms. 3 lectures, 1 laboratory. Prerequisite: CPE/EE 329 or both CSC/CPE 315 and CSC/CPE 357 or consent of instructor.

CSC 430 Programming Languages I (4)  (Also listed as CPE 430)
Construction of the front end of a compiler including lexical analysis, syntactic analysis, type checking, and formal semantics. Introduction to regular languages, finite automata, and context-free grammars. 3 lectures, 1 laboratory. Prerequisite: CSC 349 and either CSC/CPE 357 or CSC/CPE 353.

CSC 431 Programming Languages II (4)  (Also listed as CPE 431)
Language principles and design issues: bindings, conversion, parameter passing, and dynamic semantics. Language implementation: intermediate code representation, memory management, code optimization, and code generation. Functional programming languages. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 430.

CSC 435 Introduction to Object Oriented Design Using Graphical User Interfaces (4)  (Also listed as CPE 435)
Principles of object-oriented design, with emphasis on use of these principles in the design of graphical interfaces. Comparison and contrast of two major object-oriented languages and their corresponding GUI class libraries. Language-independent object-oriented design methods, and application of these methods in the construction of a GUI-based project. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103, with a grade of C- or better, or equivalent and CSC/CPE 305.

CSC 449 Current Topics in Algorithms (4)  (Also listed as CPE 449)
Selected aspects of the verification, analysis and design of algorithms. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC 349.

CSC 453 Introduction to Operating Systems (4)  (Also listed as CPE 453)
Introduction to sequential and multiprogramming operating systems; kernel calls, interrupt service mechanisms, scheduling, files and protection mechanisms, conventional machine attributes that apply to operating system implementation, virtual memory management, and I/O control systems. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 305 or both CSC/CPE 315 and CSC/CPE 357.

CSC 454 Implementation of Operating Systems (4)  (Also listed as CPE 454)
Design and implementation of multiprogramming kernels, systems programming methodology, interprocess communications, synchronization, device drivers and network access methods. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 453.

CSC 456 Introduction to Computer Security (4)  (Also listed as CPE 456)
Survey of topics in computer system and network security, including protection, access control, distributed access control, operating system security, applied cryptography, network security, firewalls, secure coding practices, and case studies from real-world systems. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 453 and either CSC 300 or CPE 350.

CSC 458 Current Topics in Computer Systems (4)  (Also listed as CPE 458)
Selected aspects of design, implementation and analysis of networks, advanced operating and distributed systems. Topics may include process management, virtual memory, process communication, context switching, file system designs, persistent objects, process and data migration, load balancing, security and networks. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 453.

CSC 464 Introduction to Computer Networks (4)  (Also listed as CPE 464)
Computer network architectures; communications protocol standards; services provided by the network; historical and current examples presented. 3 lectures, 1 laboratory. Prerequisite: STAT 312 or STAT 321 or STAT 350 and either CSC/CPE 357 or CSC/CPE 305.

CSC 465 Advanced Computer Networks (4)  (Also listed as CPE 465)
Advanced topics in computer networks; greater detail of protocol standards and services provided by the network; focus on current industry and research topics. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 464 and CSC/CPE 453.

CSC 466 New course – Effective Spring 2009; see Updates

CSC 468 Database Management Systems Implementation (4)  (Also listed as CPE 468)
Data structures and algorithms used in the implementation of database systems. Implementation of data and transaction managers: access methods interfaces, concurrency control and recovery, query processors and optimizers. Introduction to implementation of distributed database systems. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 365.

CSC 469 Distributed Computing II (4)  (Also listed as CPE 469)
Continued exploration of topics in distributed computing in greater depth, with emphasis on design patterns and team projects. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 369.

CSC 471 Introduction to Computer Graphics (4)  (Also listed as CPE 471)
Graphics software development and use of APIs for 3D graphics. The graphics pipeline, modeling, geometric and viewing transforms, lighting and shading, rendering, interaction techniques and graphics hardware. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 353 or CSC/CPE 357.
CSC 473 Advanced Rendering Techniques (4)  
(Also listed as CPE 473)
Illumination models, reflectance, absorption, emittance, Gouraud shading, Phong shading, raytracing polyhedra and other modeling primitives, coherence, acceleration methods, radiosity, form factors, advanced algorithms. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471.

CSC 474 Computer Animation (4)  
(Also listed as CPE 474)
Basic and advanced algorithms for generating sequences of synthetic images. Interpolation in time and space, procedural and keyframe animation, particle systems, dynamics and inverse kinematics, morphing and video. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471.

CSC 476 Real-Time 3D Computer Graphics Software (4)  
(Also listed as CPE 476)
Basic and advanced algorithms for real-time, interactive, 3D graphics software. Modeling (polygon mesh, height field, scene graph), real-time rendering and shading (visibility processing, LOD, texture and light maps), collision detection (bounding volumes, complexity management), interactive controls, multi-player game technology, game engine architecture. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471.

CSC 478 Current Topics in Computer Graphics (4)  
(Also listed as CPE 478)
Selected aspects of the design, implementation and analysis of computer graphics. Topics may include rendering, modeling, visualization, animation, virtual reality, computer vision, multimedia, and perception issues. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471.

CSC 479 Computer Graphics Seminar (2)
Current topics in computer graphics. Total credit limited to 4 units. 2 seminars. Prerequisite: CSC/CPE 471.

CSC 480 Artificial Intelligence (4)  
(Also listed as CPE 480)
Programs and techniques that characterize artificial intelligence. Programming in a high level language. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103, with a grade of C- or better.

CSC 481 Knowledge Based Systems (4)  
(Also listed as CPE 481)
In-depth treatment of knowledge representation, utilization and acquisition in a programming environment. Emphasis on the use of domain-specific knowledge to obtain expert performance in programs. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 480.

CSC 483 Current Topics in Human-Computer Interaction (4)  
(Also listed as CPE 483)
Selected aspects of the field of human-computer interaction. Topics may include dynamic information visualization, universal access, social impact of technology usage, educational technology, human cognition and performance studies, and extended usability evaluation techniques. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 484.

CSC 484 User-Centered Interface Design and Development (4)  
(Also listed as CPE 484)
Introduction to the importance of user-centered principles in the design of good interfaces and effective human-computer interaction. Topics include: study of human characteristics affected by interface design, effective requirements data collection and analysis, user-centered approaches to software engineering, and evaluation of interface and interaction quality. 3 lectures, 1 laboratory. Prerequisite: Junior standing and CSC/CPE 307 or CSC/CPE 308.

CSC 486 Human–Computer Interaction Theory and Design (4)
Application of the theories of human-computer interaction to the task of user-centered design. Survey of techniques for studying and involving users in different aspects of the design process, and demonstration of where and when applicable. Combining of theoretical understanding with practical experience to design solutions to problems facing interactive systems designers. 4 seminars. Prerequisite: CSC/CPE 484.

CSC 489 Current Topics in Artificial Intelligence (4)  
(Also listed as CPE 489)
Selected aspects of the design, implementation and analysis of advanced systems and concepts in the area of artificial intelligence. Topics may include knowledge representation, reasoning, learning, or planning, and specific techniques like intelligent agents, genetic algorithms, semantic web, or robotics. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 480.

CSC 490 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Consent of instructor.

CSC 491 Senior Project Design Laboratory I (2)
Selection and completion of a project by individuals or team which is typical of problems which graduates must solve in their fields of employment. Project may include students from other disciplines. Formulation of outline, literature review, and project schedule. 2 laboratories. Prerequisite: CSC 491 and consent of instructor.

CSC 492 Senior Project Design Laboratory II (3)
Selection and completion of a project by individuals or team which is typical of problems which graduates must solve in their fields of employment. Project may include students from other disciplines. Project results are presented in a formal report. 3 laboratories. Prerequisite: CSC 491 and consent of instructor.

CSC 493 Cooperative Education Experience (2)  
(CR/NC)
Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. Total credit limited to 6 units. Prerequisite: Sophomore standing and consent of instructor.

CSC 494 Cooperative Education Experience (6)  
(CR/NC)
Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. Total credit limited to 18 units. Prerequisite: Sophomore standing and consent of instructor.

CSC 495 Cooperative Education Experience (12)  
(CR/NC)
Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. Total credit limited to 24 units. Prerequisite: Sophomore standing and consent of instructor.

CSC 500 Directed Study (2–3)  
(CR/NC)
Individual directed study of advanced topics. Total credit limited to 4 units. Credit/No Credit grading only. Prerequisite: Fully classified graduate standing and consent of instructor.

CSC 508 Software Engineering I (4)
In-depth study of requirements engineering, software project management, formal specifications and object-oriented analysis. 4 seminars. Prerequisite: CSC/CPE 307 or CSC/CPE 308 and graduate standing, or consent of instructor.

CSC 509 Software Engineering II (4)
In-depth study of software modeling and design. Formal design methodologies. Design patterns. Detailed case studies of existing projects. Tools and methods for designing large software systems. 4 seminars. Prerequisite: CSC 508 and graduate standing, or consent of instructor.
CSC 520 Computer Architecture (4) (Also listed as CPE 520)
Comparative study and design of multiprocessor, dataflow, RISC, high level language and other new computer architectures. VLSI processor design techniques. 3 seminars, 1 laboratory. Prerequisite: CSC/CPE 315 and graduate standing, or consent of instructor.

CSC 530 Languages and Translators (4)
Advanced programming language and translator concepts. Language concepts to be covered will be selected from current state-of-the-art languages and current issues in language design. Compiler concepts will include retargetable code generation, use of translator-writing systems, and error recovery. 4 seminars. Prerequisite: CSC 430 and graduate standing, or consent of instructor.

CSC 540 Theory of Computation II (4)
Advanced topics in theoretical computer science from such areas as automata theory, cellular automata theory, computational complexity, and program verification. 4 seminars. Prerequisite: CSC 445 and graduate standing, or consent of instructor.

CSC 541 Numerical Methods (4)
Introduction to advanced methods used in numerical analysis. Finite element methods for one and two-dimensional problems. Study of transforms including the Fast Fourier Transform and the Fast Hartley Transform. Review of the software supporting these methods. 4 seminars. Prerequisite: CSC 342 and graduate standing, or consent of instructor.

CSC 550 Operating Systems (4)
General concepts of computer architecture and operating systems. Design features of advanced computers, general time-sharing systems and schemes for dynamic memory allocation, scheduling and protection. Dynamic linkage between subroutines. Intercommunication between input/output and processors. 4 seminars. Prerequisite: CSC/CPE 453 and graduate standing, or consent of instructor.

CSC 556 New course – Effective Spring 2009; see Updates

CSC 560 Database Systems (4)
Current topics in database systems: distributed databases and transactions, nested and long-running transactions, distributed concurrency control, semantic and object-oriented data models, database systems for non-traditional applications: engineering design databases, active, logic, temporal, multimedia, and real-time databases. 4 seminars. Prerequisite: CSC/CPE 468 and graduate standing, or consent of instructor.

CSC 564 Computer Networks: Research Topics (4)
(Also listed as CPE 564)
Exploration of advanced topics in emerging computer networking technologies; focus on leading edge computer network research topics. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 464 and graduate standing, or consent of instructor.

CSC 568 Distributed Systems (4)
Advanced topics in distributed systems with emphasis on recent and emerging distributed computing paradigms, fault tolerance, and distributed algorithms. 4 seminars. Prerequisite: CSC/CPE 369 or CSC/CPE 569 and graduate standing, or consent of instructor.

CSC 569 Distributed Computing (4) (Also listed as CPE 569)
Principles and practices in distributed computing: interprocess communications, group communications, client-server model, distributed objects, message queue system, distributed services, mobile agents, object space, Internet protocols. Distributed algorithms: consensus protocols, global state protocols. Fault tolerance: classification of faults, replication. Not open to students with credit in CSC/CPE 369 or CSC/CPE 469. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357 or CSC/CPE 353 and graduate standing, or consent of instructor.

CSC 570 Current Topics in Computer Science (2–4)
Directed group study of selected topics for graduate students. Topics will normally consist of continuations of those in CSC 520, CSC 530, CSC 540, CSC 550, CSC 560 and CSC 580, and other topics as needed. The Schedule of Classes will list topic selected. Topic credit limited to 12 units. 2 to 4 seminars. Prerequisite: Graduate standing and evidence of satisfactory preparation in computer science.

CSC 572 Computer Graphics (4)
Advanced topics in computer graphics with emphasis on leading edge computer graphics technologies and advanced topics in graphics fundamentals. 3 lectures, 1 laboratory. Prerequisite: Successful completion of CSC/CPE 471 and graduate standing, or consent of instructor.

CSC 580 Artificial Intelligence (4) (Also listed as CPE 580)
Current research in the field of artificial intelligence with emphasis on cooperative agents, distributed agents, and decision making in complex, concurrent environments. AI programming in a distributed environment. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 481 and graduate standing, or consent of instructor.

CSC 581 Computer Support for Knowledge Management (4)
(Also listed as CPE 581)
Use methods and techniques that computer-based systems can provide to make the management of knowledge and information in digital form easier for the user. Emphasis on support for knowledge-intensive activities performed by users. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 481.

CSC 590 Seminar in Computer Science (3)
Current problems and research in the field of computer science through discussions and selected readings. Group study of selected advanced topics. 3 seminars. Prerequisite: Graduate standing or consent of instructor.

CSC 593 Cooperative Education Experience (2) (CR/NC)
Advanced study analysis and full-time work experience in student’s career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

CSC 594 Cooperative Education Experience (6) (CR/NC)
Advanced study analysis and full-time work experience in student’s career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

CSC 595 Cooperative Education Experience (12) (CR/NC)
Advanced study analysis and full-time work experience in student’s career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

CSC 599 Thesis/Project (2–3) (2–3)
Individual research or activity under faculty supervision leading to an acceptable thesis or project. Prerequisite: Graduate standing and consent of instructor.

DANC–DANCE

DANC 130 Pilates/Physicalmind Conditioning Method (2)
Introduction to Joseph Pilates Physicalmind conditioning method, providing the ideal physical fitness for the attainment and maintenance of a uniformly developed body and sound mind. Total credit limited to 6 units. 2 activities.

DANC 131 Beginning Ballet (2)
Fundamentals of ballet technique stressing alignment, turn-out, five basic positions, seven movements of dance, and terminology. Total credit limited to 6 units. 2 activities.

DANC 132 Beginning Modern Dance (2)
Fundamentals of modern technique stressing alignment, off-centered use of torso, floorwork, movement phrases, and improvisation exercises. Total credit limited to 6 units. 2 activities.

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DANC 133  Beginning Jazz Dance (2)
Introduction of jazz dance techniques stressing a variety of styles, alignment, isolation, polyrhythms, syncopation, improvisation, and phrasing. Performance technique and presentation of simple dance phrases. Total credit limited to 6 units. 2 activities.

DANC 134  Beginning Ballroom Dance (2)
Selected ballroom dances including the cha-cha-cha, foxtrot, merengue, rumba, samba, swing, tango, waltz, and line dance hustle. Emphasis on alignment, etiquette, leading and following, performance techniques, and presentation of simple dance phrases. Total credit limited to 6 units. 2 activities.

DANC 135  International Folk Dance (2)
Introduction to international folk dances including round, longway, and square sets. Study of various dance steps, formation, positions, historical and cultural background. Total credit limited to 6 units. 2 activities.

DANC 139  Beginning Tap (2)
Introduction to tap dance technique stressing rhythms and breaks, syncopation, and improvisation. Study of different tap styles and related cultural influences. Performance of beginning tap dance phrases. Total credit limited to 6 units. 2 activities.

DANC 211  Dance Fundamentals (2)
Body placement, alignment, rhythmic analysis and movement techniques. Theory and practice of fundamentals to promote ease and efficiency of movement. Introduction to dance forms such as ballet, modern, jazz, folk, square and social. 2 activities.

DANC 221  Dance Appreciation (4)  GE C3
Diverse dance forms. Focus on major western dance artists and their works from the 19th century to the present. Cultural context, style and forms in dance. Introductory survey of major experiments in dance. 4 lectures.

DANC 231  Intermediate Ballet (2)
Continuation of training in basic technical skills in ballet stressing phrasing, performance, and more complex step patterns. Total credit limited to 6 units. 2 activities. Prerequisite: Intermediate level experience as determined by instructor at first class meeting.

DANC 232  Intermediate Modern Dance (2)
Continuing study of DANC 132 with emphasis on various movement styles, phrasing, more complex step patterns, and performance. Total credit limited to 6 units. 2 activities. Prerequisite: Intermediate level experience as determined by instructor at first class meeting.

DANC 233  Intermediate Jazz Dance (2)
Continuation of DANC 133 with emphasis on more extensive movement vocabulary. Total credit limited to 6 units. 2 activities. Prerequisite: Intermediate level experience as determined by instructor at first class meeting.

DANC 234  Intermediate Ballroom Dance (2)
Continuation of DANC 134. Selected ballroom dances: cha cha, foxtrot, merengue, rumba, swing, tango, hustle, paso doble, polka and samba. Emphasis on variations, styles, and performance skill. Total credit limited to 6 units. 2 activities. Prerequisite: DANC 134 or intermediate level experience as determined by instructor at first class meeting.

DANC 311  Dance in American Musical Theatre (4)  GE C4
Cultural norms portrayed through dance and musical production. Major works with multicultural, racial, class, and gender issues associated with American themes. The artists, the role of dance in the musical theatre, and the significance of dance in human society. 4 lectures. Prerequisite: Completion of GE Area A and one course in Area C3. Theatre Arts majors will not receive GE C4 credit.

DANC 321  Cultural Influence on Dance in America (4)  GE C4  USCP
A multicultural approach to the history of dance in America, with emphasis on American Indian, West African, Caribbean, Mexican, European, and Asian contributions and influences. Explores culture through dance in lecture, readings, video samples, and written observations of dance performance. Purchase of concert ticket(s) required. 4 lectures. Prerequisite: Completion of GE Area A and one lower division Area C course. Theatre Arts majors will not receive GE C4 credit.

DANC 331  Advanced Ballet and Repertory (2)
Advanced ballet technique and reconstruction of historical ballet repertories from the romantic, classical, neoclassical, and modern periods. Participation in dance performance of selected repertory. Total credit limited to 6 units. 2 activities. Prerequisite: DANC 231 or intermediate level experience as determined by instructor at first class meeting.

DANC 332  Modern Dance Repertory (2)
Intermediate to advanced dance skills learned through the study and performance of selected modern dance repertory. Addresses problems in advanced performance technique. Informal presentation in performance situation. Total credit limited to 6 units. 2 activities. Prerequisite: Intermediate level experience as determined by instructor at first class meeting.

DANC 340  Dance Composition (4)
Principles of dance composition. Exploration of the creative potential of movement and development of movement motifs through choreographic studies. Preparation for informal public presentation of student generated solo or group choreographic works. Total credit limited to 8 units. 1 lecture, 1 laboratory, 2 activities. Prerequisite: Intermediate level experience as determined by instructor at first class meeting.

DANC 345  Choreography and Workshop in Dance Concert Preparation (4)
Problems connected with dance choreography. Workshop in concert preparation for major public dance production. Attendance of professional dance concert required. Attendance of professional dance concert(s) required. Total credit limited to 16 units. 2 activities, 2 laboratories. Prerequisite: By audition only.

DANC 346  Dance Production (4)
Directed experience in production of annual Orchesis Dance Company Concert and other public performances. Attendance of professional dance concert(s) required. Total credit limited to 16 units. 1 activity, 3 laboratories. Prerequisite: DANC 345.

DANC 381  Dance for KINE/Dance Minors (4)
Dance skills and techniques. Experience in selected dance forms. Rhythmic structure and analysis of dance steps. Includes introduction to dance pedagogy, curricular materials and evaluative procedures. 2 lectures, 2 activities. Prerequisite: KINE 419 or KINE 310, Dance Minor or consent of instructor.

DANC 400  Special Problems for Advanced Undergraduates (1–4)
Individual investigation, research and studies or survey of selected problems in dance and related areas. Total credit limited to 8 units with a maximum of 4 units per quarter. Prerequisite: Consent of instructor and department head.

DANC 470  Selected Advanced Topics (1–4)
Directed study of selected topics for advanced dance students. The Schedule of Classes will list topics selected. Total credit limited to 8 units. 1–4 lectures. Prerequisite: Consent of instructor.

DANC 471  Selected Advanced Laboratory (1–4)
Directed group laboratory study of selected topics for dance students. The Schedule of Classes will list topics selected. Total credit limited to 8 units. 1–4 laboratories. Prerequisite: Consent of instructor.

DSCI–DAIRY SCIENCE

DSCI 100  Enterprise Project (1–4) (CR/NC)
Selection and completion of a management/production project under faculty supervision. Project participation is subject to approval by the project supervisor and the Cal Poly Corporation. Degree credit limited to 12 units. Credit/No Credit grading only.
DSCI 101 Dairy Feeds and Feeding (4)
Introduction to Dairy Cattle/Ruminant Nutrition. Classification and metabolism of nutrients. Nutrient content and identification of feeds common to dairy cattle. Nutrient analysis procedures and requirements. Ration formulation, feeding practices for maximizing growth and milk production. 3 lectures, 1 laboratory.

DSCI 121 Elements of Dairying (4)
General information on statistics and opportunities in the dairy industry. Dairy cattle record keeping systems and their use in dairy herds. Principles of reproduction management, milking and milking machine function. Principles and practices of the feeding and management of dairy cattle. 3 lectures, 1 laboratory.

DSCI 123 Dairy Science Orientation (1) (CR/NC)
Curricula, career paths, and opportunities for involvement in the dairy industry. Campus resources and tips for academic success. Student and professional organizations and affiliations. Meet and interact with each member of the faculty, Dairy Club officers, and industry guests. Credit/No Credit grading only. 1 lecture.

DSCI 134 Introduction to Dairy Products Technology (4)
Science and technology in the development and manufacture of dairy food products. Equipment and dairy processing techniques for fluid milk, butter, cheeses, ice cream, yogurt, concentrated dairy foods and dried dairy foods. 3 lectures, 1 laboratory.

DSCI 200 Special Problems for Undergraduates (1–2)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of instructor.

DSCI 202 Dairy Promotion and Marketing (4)
National and state dairy promotional programs, advertising and merchandising. Marketing and pricing of milk and dairy products at the state and national level. 4 lectures. Prerequisite: DSCI 134 or consent of instructor.

DSCI 223 Frozen Dairy Foods (4)
Technology, equipment, mix calculations and preparation required to process, freeze, package, harden and distribute ice cream and related products. 3 lectures, 1 laboratory. Prerequisite: DSCI 134.

DSCI 230 General Dairy Husbandry (4)
Selection, breeding, feeding, and management of dairy cattle. Composition and food value of dairy products. Milk pricing, political influences, dairy industry statistics and opportunities. Producing and handling products. Intended as introductory course for non-dairy science majors. 3 lectures, 1 laboratory.

DSCI 231 General Dairy Manufacturing (4)
Composition and properties of fluid milk and manufactured milk products. Chemistry and microbiology of dairy products. Processes and equipment involved in the manufacture of butter, cheeses, and other fermented dairy products, frozen, condensed, and dried dairy foods. Intended as introductory course for non-dairy science students. Survey course for dairy husbandry majors. 3 lectures, 1 laboratory.

DSCI 233 Milk Processing and Inspection (4)
Composition and properties of fluid milk and its constituents. Equipment used to handle, process, and distribute fluid milk and related products. California dairy codes used for dairy farms and plants, with practice inspections of dairy farms and factories. 3 lectures, 1 laboratory. Prerequisite: DSCI 134.

DSCI 234 Dairy Foods Evaluation (2)
Basic principles of sensory evaluation of dairy foods, physiology of various senses and their relationship to distinguishing the quality of dairy products by sight, flavor, body and texture. Product defects, causes, and methods of prevention. 1 lecture, 1 laboratory.

DSCI 241 Dairy Cattle Selection, Breeds, Fitting and Showing (4)
Selection of dairy cattle on type conformation and the correlation between type and production. Dairy cattle breeds and breed comparisons. Techniques to properly condition, groom and present dairy cattle for evaluation and merchandising. 2 lectures, 2 activities. Prerequisite: DSCI 121 or DSCI 230.

DSCI 301 Dairy Cattle Nutrition (4)
Principles of dairy cattle nutrition and management and their application to economical feeding practices and computerized ration formulation. 3 lectures, 1 activity. Prerequisite: DSCI 101 and DSCI 121 or DSCI 230.

DSCI 321 Lactation Physiology (4)
Mechanisms of milk component secretion, including protein, lactose and fat metabolism. Disorders of the mammary gland (mastitis) and control strategies. Endocrine aspects of mammary gland development and lactogenesis. 4 lectures. Prerequisite: DSCI 101, DSCI 121, BIO 161, CHEM 111.

DSCI 330 Artificial Insemination and Embryo Biotechnology (4)
Techniques in the collection, evaluation and processing of semen, along with embryo culturing and manipulation. Insemination procedures, fertilization problems, record keeping, estrous synchronization, endocrine control of reproduction, treating reproductive disorders and embryo transfer. 3 lectures, 1 laboratory. Prerequisite: DSCI 121 or DSCI 230 or VS 223 or consent of instructor.

DSCI 333 Dairy Cattle Management, Safety and Animal Well-Being (4)
Modern dairy management techniques, livestock handling and animal comfort. Dairy safety and development of an injury illness prevention program. Animal well-being issues and the Pasteurized Milk Ordinance. 3 lectures, 1 activity. Prerequisite: DSCI 121 or DSCI 230.

DSCI 339 Internship in Dairy Science (1–12) (CR/NC)
Selected Dairy Science students will spend up to 12 weeks with an approved agricultural firm engaged in production or related business. Time will be spent applying and developing production and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Degree credit limited to 12 units. Credit/No Credit grading only. Prerequisite: Consent of internship instructor.

DSCI 350 Dairy Industry Communications (2)
Application of information and computer technology to creation of dairy publications. Exploration of Web resources for dairy-related current events and information. Financial, promotional, creative and technical aspects of producing dairy brochures, catalogs, annuals and pamphlets. Total credit limited to 8 units. 2 activities. Prerequisite: ENGL 134, DSCI 121, AG 250 or consent of instructor.

DSCI 400 Special Problems for Advanced Undergraduates (1–2)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of instructor.

DSCI 401 Physical and Chemical Properties of Dairy Products (4)
Composition, structure and properties of milk and milk products. Physical and chemical changes that occur during processing and storage of dairy products. Objective measurement of chemical and physical properties. 3 lectures, 1 laboratory. Prerequisite: CHEM 212/312 or consent of instructor.

DSCI 402 Quality Assurance and Control of Dairy Products (4)
Current methods used to evaluate dairy products with respect to plant economics and consumer safety. Accurate procedures for chemical and biological testing, statistical approach to sampling and design and interpretation of HACCP programs for assuring product quality and safety. 3 lectures, 1 laboratory. Prerequisite: CHEM 212/312 or consent of instructor.

DSCI 412 Dairy Farm Consultation (4)
Student consultation teams of three or four students visit dairies and/or attend management training seminars followed by presenting management recommendations to the dairy owners, consultants, and other industry leaders. 1 seminar and supervised work. Prerequisite: DSCI 121 or DSCI 230, DSCI 330, DSCI 333, junior standing.
DSCI 422 Breeding and Genetics of Dairy Cattle (4)
Evaluation of inherited characteristics in dairy cattle from an economic standpoint. Proving and selecting sires and dams. 4 lectures. Prerequisite: DSCI 241.

DSCI 432 Advanced Dairy Herd Management (4)
Dairy herd management skills needed in dairy operations. Instruction and lab experience in management, records, feeding and nutrition, herd health, milk secretion, reproduction, mating and selection. 4 lectures. Prerequisite: DSCI 301, DSCI 241, DSCI 330, and DSCI 422.

DSCI 433 Dairy Plant Management and Equipment (4)
Basic management principles applied to the dairy industry. Industrial organization and control. Dairy plant design, facilities, layout. Inventory control and records. Milk pooling and stabilization records. Maintenance and operation of equipment. 3 lectures, 1 laboratory. Prerequisite: DSCI 233, DSCI 434.

DSCI 434 Cheese and Fermented Dairy Foods (4)
Scientific methods, ingredients, and equipment used in the manufacture of various fermented dairy products, including cheeses, buttermilk, sour cream, and yogurt. 3 lectures, 1 laboratory. Prerequisite: DSCI 134, MCRO 221.

DSCI 435 Concentration/Fractionation and Butter Technology (4)
Technology of evaporation, drying and membrane separation processes applied to dairy fluids. Design and performance of evaporators, driers, and membrane processing systems. Equipment, ingredients, and methods needed to manufacture butter and dairy spreads. 3 lectures, 1 laboratory. Prerequisite: DSCI 134.

DSCI 444 Dairy Microbiology (4)
Microorganisms involved in the fermentation and ripening processes in the dairy industry, as well as those involved in spoilage of milk and dairy products, in the transmission of disease through these products, and indicator systems used to determine sanitary quality of these products. 2 lectures, 2 laboratories. Prerequisite: MCRO 221 or MCRO 224.

DSCI 461 Senior Project (3)
Selection and completion of a project under faculty supervision. Projects are typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal written report. 2 lectures and supervised work. Prerequisite: Junior standing.

DSCI 462 Senior Project (2)
Completion of a project under faculty supervision. Project results are presented in a formal written report. Supervised work. Prerequisite: Consent of supervising faculty member.

DSCI 463 Undergraduate Seminar (2)
Reports on student papers, bulletins, periodical articles, and dairy research experiments. Sources of dairy husbandry information. Practice in oral reporting. Recent developments and research work in the dairy industry. 2 seminars.

DSCI 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 seminars. Prerequisite: Senior or graduate standing and approval of instructor.

DSCI 522 Bioseparation Processes in Dairy Product Technology (4)
Physical and chemical principles governing bioseparation processes in dairy product technology. Factors influencing mass transport phenomena as it relates to filtration, chromatography, ion exchange, dialysis, centrifugation, adsorption, crystallization and other unit operations. Laboratories to emphasize application of bioseparations of commercial importance. Field trips to be required. 3 lectures, 1 laboratory. Prerequisite: DSCI 401, FSN 444.

DSCI 539 Graduate Internship in Dairy Science (1–9)
Application of theory to the solution of problems of agricultural production or related business in the field of Dairy Science. Analyze specific management problems and perform general management assignments detailed in a contract between the student, the firm or organization, and the faculty advisor before the internship commences. Degree credit limited to 6 units. Prerequisite: Consent of internship instructor.

DSCI 560 Recent Developments in Dairy Science and Technology (1–3)
Presentation and critical review of current research publications. Methodological advances and applications in dairy food systems. The Schedule of Classes will list topic selected. Total credit limited to 6 units. 1–3 seminars. Prerequisite: Consent of instructor.

DSCI 570 Selected Topics in Dairy Science (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 1 to 4 seminars. Prerequisite: Consent of instructor.

DSCI 571 Selected Advanced Laboratory in Dairy Science (1–4)
Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1–4 laboratories. Prerequisite: Consent of instructor.

DSCI 581 Graduate Seminar in Dairy Science (1–3) (CR/NC)
Current findings and research problems in the field and their application to industry. Group study of current problems of industry. Current experimental and research findings as applied to production and marketing. Credit/No Credit grading only. 1 or 3 seminars. Credit/No Credit grading only. Prerequisite: Graduate standing or consent of instructor.

DSCI 585 Cooperative Education Experience in Dairy Science (1–6) (CR/NC)
Advanced study, analysis and part-time work experience in the field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 9 units. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

DSCI 599 Thesis in Dairy Science (1–9)
Systematic research of a significant problem in Dairy Science. Thesis will include problem identification, significance, methods, data analysis, and conclusion. Students must enroll every quarter in which facilities are used for thesis work. Total credit limited to 6 units. Prerequisite: Graduate standing and consent of instructor.

ECON–ECONOMICS

ECON 200 Special Problems for Undergraduates (1–2)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Sophomore standing and consent of department head.

ECON 201 Survey of Economics (4) GE D2
(Also listed as HNRS 201)
Basic principles of microeconomics and macroeconomics. Emphasis on applications to current national and global economic issues. For majors requiring one quarter of economics. Not open to students having previous credit in ECON 222 or equivalent. 4 lectures.

ECON 221 Microeconomics (4)
Microeconomic principles. Marginal and equilibrium analysis of commodity and factor markets in determination of price and output. Normative issues of efficiency and equity. 4 lectures.

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ECON 222  Macroeconomics (4)  GE D2

ECON 303  Economics of Poverty, Discrimination and Immigration (4)  Also listed as HRNS 303  GE D5  USCP
Economic analysis of the cause, extent and impact of poverty, discrimination and immigration and of the policies designed to address these socioeconomic issues. Emphasis on the experience of African-Americans, Latinos, and women in the United States. 4 lectures. Prerequisite: Completion of GE Areas A, D1, and either ECON 221 and ECON 222, or ECON 201. Economics majors will not receive GE Area D5 credit.

ECON 304  Comparative Economic Systems (4)  GE D5
Analysis of economic systems as a set of mechanisms and institutions for decision making, and the implementation of decisions regarding income distribution, the levels of consumption and production, and the level of economic welfare. 4 lectures. Prerequisite: Completion of GE Areas A, D3, and either ECON 221 and ECON 222, or ECON 201. Economics majors will not receive GE Area D5 credit.

ECON 311  Intermediate Microeconomics (4)
Economics of prices and markets. Demand and supply. Returns and costs, factor pricing and income distribution, welfare and economic progress. 4 lectures. Prerequisite: MATH 142 or MATH 221, and STAT 252 or STAT 302, and either ECON 221 and ECON 222, or ECON 201.

ECON 312  Economic History of the Advanced World (4)  GE D5
Analysis of the growth of economic institutions from about 600. Includes the spread of economic structures and institutions to colonies. Analyzes the internal development of the industrial economy in Europe and its expansion to other parts of the globe. 4 lectures. Prerequisite: Completion of GE Areas A, D3, and either ECON 221 and ECON 222, or ECON 201. Economics majors will not receive GE Area D5 credit.

ECON 324  American Economic History (4)
Topical and statistical analysis of the major trends and events of American economic history. Examines the causes and evolution of the United States economy from colonial times to the present. Assessment of agriculture, transportation, industrial and government sectors and their interconnections. 4 lectures. Prerequisite: Completion of GE Areas A, D1, and either ECON 221 and ECON 222, or ECON 201.

ECON 325  Economics of Development and Growth (4)
Analysis of the economy of less developed countries, and a survey of public policies designed to stimulate economic growth and reduce poverty. Topics include financing development, technology, population problems, human capital, rural and urban development, trade policy and the economic relationships between developed and developing nations. 4 lectures. Prerequisite: Completion of GE Areas A, D3, and either ECON 221 and ECON 222, or ECON 201.

ECON 330  International Trade (4)  formerly ECON 401
Theory of comparative advantage, gains from trade, and recent developments in trade theory; examination of tariffs, quotas, exchange controls, other trade barriers and underlying policy issues; review of U.S. comer-cial policy, GATT, the common market, regional and world economic organizations. 4 lectures. Not open to students with credit in ECON 404 or equivalent. Prerequisite: Either ECON 221 and ECON 222, or ECON 201.

ECON 337  Money, Banking and Credit (4)
Financial markets and institutions. Structure of the banking industry and impacts of technological change in banking. Structure and operations of the Federal Reserve. Impacts of monetary policy on the economy. 4 lectures. Prerequisite: Either ECON 221 and ECON 222, or ECON 201.

ECON 339  Econometrics (4)
Application of statistical methods useful in economics. General linear regression model. Specific issues and problems related to economic models: multicollinearity, autocorrelation, heteroscedasticity, dummy variables, lagged variables, and simultaneous equation estimation. Application and evaluation of selected examples of empirical economic research. Microcomputer applications. 3 lectures, 1 activity. Prerequisite: MATH 142 or MATH 221, and STAT 252 or STAT 302, and either ECON 221 and ECON 222, or ECON 201, or consent of instructor.

ECON 340  Advanced Econometrics (4)
Advanced topics in undergraduate econometrics. Single equation estimation topics including: distributed lag models, causality, cointegration and error correction models and nonlinear estimation. Forecasting with a single equation model. Simultaneous equation estimation, including instrumental variables, two stage least squares and seemingly unrelated regression. 3 lectures, 1 activity. Prerequisite: ECON 339.

ECON 400  Special Problems for Advanced Undergraduates (1–4)
Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units. Prerequisite: Consent of department head.

ECON 403  Industrial Organization (4)
Application of basic tools of economics to American Industry. Case studies of individual firms and industries. Performance of various business structures, such as monopoly and oligopoly. Effects of government regulation and antitrust policy. 4 lectures. Prerequisite: ECON 311 or consent of instructor.

ECON 404  International Trade Theory (4)
Theory of comparative advantage, neoclassical model of trade, offer curves and terms of trade, edgeworth boxes, valuation of factor inputs, effects of migration and mobility of funds, emerging growth and trade distortions, welfare effects of trade, and recent developments in trade theory. 4 lectures. Prerequisite: ECON 311 or consent of instructor.

ECON 405  International Monetary Economics (4)
Nature of international payments, U.S. balance of payments. Theory and practice of foreign exchange rate determination under the gold standard, paper standard, and IMF system; international money and capital markets; problems of international liquidity and monetary stability. 4 lectures. Prerequisite: ECON 311 and ECON 404, or consent of instructor.

ECON 406  Applied Forecasting (4)
Causation and measurement of business fluctuations. Techniques of forecasting with microcomputer applications. 3 lectures, 1 activity. Prerequisite: ECON 311 and ECON 339, or consent of instructor.

ECON 408  Mathematical Economics (4)  formerly ECON 310
Applications of quantitative techniques to topics in microeconomic and macroeconomic theory. Use of multivariate calculus and linear algebra in formulating static economic models. Applications of statistical inference, estimation and forecasting in economic models. 4 lectures. Prerequisite: ECON 313, or consent of instructor.

ECON 410  Public Finance and Cost-Benefit Analysis (4)
Principles of rational decision making with respect to government revenues and spending. Measurement of costs and benefits, and criterion selection. Taxation, user fees, deficit financing, public goods, neighborhood effects and zoning. Microcomputer applications. 4 lectures. Prerequisite: ECON 311, or consent of instructor.

ECON 413  Labor Economics (4)
Wage determination theory, basic economic factors that affect the labor movement, economic impact of union activities on employment, output, income, wages, prices, and national economic policy. 4 lectures. Prerequisite: ECON 311, or consent of instructor.

ECON 417  Development of Economic Analysis (4)
Analysis of ideas related to the development of economic theory in the Western civilization from the Greeks through the classical, neoclassical,
and Keynesian to the current post-Keynesian concepts. 4 lectures. Prerequisite: ECON 311, or consent of instructor.

ECON 420 Advanced Macroeconomics (4)
Macroeconomics for advanced students. Inflation, unemployment, interest rates, real output, exchange rates, business cycles and macroeconomic policy. Analysis of current data on the macro-economy within the scope of competing views on the macro-economy. 4 lectures. Prerequisite: ECON 313, or consent of instructor.

ECON 424 Monetary Economics (4)
The role of money in our economy. Focus on the links between monetary policy, interest rates, prices, housing markets, mortgage lending and overall economic activity. Public policy issues relating to real estate markets. 4 lectures. Prerequisite: ECON 313, or consent of instructor.

ECON 430 Internship (2–8) (CR/NC)
Placement of student for part-time supervised work experience in a business enterprise or government agency approved by the area chair. Collateral reading correlated with work assignments and periodic written progress reports required. Credit/No Credit grading only. Prerequisite: approval of area chair, junior standing, and a CPSLO cumulative GPA of at least 2.5 without being on academic probation.

ECON 431 Environmental Economics (4)
Economic dimensions of environmental abuse and protection. Use of simple economic models in developing and evaluating environmental policies. Overview of current environmental problems. Issues related to the sustainability of economic growth at the national and international levels. 4 lectures. Prerequisite: ECON 311, or consent of instructor.

ECON 432 Economics of Energy and Resources (4)
Economic theory and public policies as applied to problems of natural resources and energy. Dynamic resource and energy models developed with reference to public and private sector growth. Application of the principles of capital theory emphasized. Case studies. Computer software applications in the study of natural resources and energy under uncertainty. 4 lectures. Prerequisite: ECON 311, or consent of instructor.

ECON 433 Transportation Economics (4)
Analysis of the allocation of resources to the U.S. transport sector and specific transport modes as a result of their natural economic characteristics and public policy. 4 lectures. Prerequisite: ECON 311, or consent of instructor.

ECON 434 Urban Economics (4)
Application of basic tools of economic analysis to problems of urban regions. Causes and possible cures for inadequate growth rate, income levels, and the quality of life in urban regions. 4 lectures. Prerequisite: ECON 311, or consent of instructor.

ECON 435 Economics of Land and Water (4)
Economic analysis of natural resource issues, policies and management with an emphasis on land and water use decisions in the western U.S. Urban demand for water; water supply and economic growth; economic impacts of surface water law and institutions; economics of land management. 4 lectures. Prerequisite: ECON 311, or consent of instructor.

ECON 461, 462 Senior Project I, II (2) (2)
Selection and analysis of a problem under faculty supervision. Problems typical of those which graduates must solve in their fields of employment. Formal report is required. Minimum 120 hours total time. Prerequisite: ECON 313 and senior standing.

ECON 464 Applied Senior Project (4)
Analysis of selected economic topics and problems in directed individual or group-based projects, which require application of economic models, principles and theory to investigate important business, economic or social issues. Formal report required. 4 seminars. Prerequisite: ECON 313 and senior standing.

ECON 470 Selected Advanced Topics (1–4)
Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Consent of instructor.

ECON 500 Independent Study (1–4)
Advanced study planned and completed under the direction of a departmental faculty member. Open only to graduate students demonstrating ability to do independent work. Enrollment by petition. Prerequisite: Consent of department head.

ECON 510 Quantitative Methods (4)
Review and discussion of the basic math tools needed for graduate work in economics, including set theory, linear algebra, properties of functions, static and dynamic optimization. 4 lectures. Prerequisite: ECON 408 or MATH 244 or equivalent, and graduate standing, or consent of instructor.

ECON 511 Microeconomic Analysis (4)
Basic microeconomic theory including theory of the firm, consumer theory, general equilibrium, capital theory, and welfare economics. 4 lectures. Prerequisite: Concurrent with ECON 510 and graduate standing, or consent of instructor.

ECON 512 Macroeconomic Analysis (4)
The use of statistical procedures to measure theoretical economic relationships and to verify and reject theories. Advanced coverage of regression analysis and hypothesis testing. 4 lectures. Prerequisite: ECON 339, ECON 511 and graduate standing, or consent of instructor.

ECON 516 Advanced Macroeconomics (4)
Analysis of the international movement of goods, services, capital and natural resource conservation. Static and dynamic efficiency, economic growth and sustainability, pollution taxes, marketable permits, and the design of market-based regulations. 4 lectures. Prerequisite: ECON 511 and graduate standing, or consent of instructor.

ECON 532 Environmental and Natural Resource Economics (4)
Economic analysis of pollution, congestion, public good provision, and natural resource conservation. Static and dynamic efficiency, economic growth and sustainability, pollution taxes, marketable permits, and the design of market-based regulations. 4 lectures. Prerequisite: ECON 511 and graduate standing, or consent of instructor.

ECON 533 Environmental and Natural Resource Economics (4)
Economic Analysis of pollution, congestion, public good provision, and natural resource conservation. Static and dynamic efficiency, economic growth and sustainability, pollution taxes, marketable permits, and the design of market-based regulations. 4 lectures. Prerequisite: ECON 511 and graduate standing, or consent of instructor.

ECON 534 International Economics (4)
Economic Analysis of pollution, congestion, public good provision, and natural resource conservation. Static and dynamic efficiency, economic growth and sustainability, pollution taxes, marketable permits, and the design of market-based regulations. 4 lectures. Prerequisite: ECON 511 and graduate standing, or consent of instructor.

ECON 536 Public Economics (4)
Analysis of the rationale for public expenditure and taxation. Externalities, pollution and public policy, income redistribution and public welfare, public goods, collective choice and political institutions, public budgeting techniques and cost-benefit analysis, taxation and tax policy, state-local finance and fiscal federalism. 4 lectures. Prerequisite: ECON 511 and graduate standing, or consent of instructor.

ECON 538 Industrial Economics (4)
Economic Analysis of industrial organization with specific reference to such topics as cartels, market concentration and performance, vertical integration, franchise contracts, ownership and control of firms, multipart and discriminatory pricing, and tie-in sales. Economic aspects of antitrust law and government regulation of industry. 4 lectures. Prerequisite: ECON 511 and graduate standing, or consent of instructor.
ECON 580 Seminar in Economics (1-4)
Advanced topics in economics chosen according to the common interests and needs of the students enrolled. Schedule of Classes will list topic selected. 1-4 seminars. Prerequisite: Graduate standing or consent of instructor.

ECON 599 Thesis (4)
Individual research under the general supervision of the faculty, leading to a graduate thesis of suitable quality. Minimum of 8 units required for degree. Prerequisite: Graduate standing and consent of thesis committee.

**EDES–ENVIRONMENTAL DESIGN**

EDES 101 Introduction to Architecture and Environmental Design (2) (CR/NC)
Familiarization with the professional fields of architecture, landscape architecture, structural engineering, construction, and city planning. Introduction to the college's programs as they relate to individual aptitudes. The design process. Visiting speakers. Credit/No Credit grading: 2 lectures.

EDES 333 Professional Presentations (4)
Skills and tools for employment acquisition or graduate school admissions. Individual resume design and production. Documentation of personal, professional and academic experience via written, oral and image based systems. Employment interview dynamics. Electronic and hardcopy portfolio production. Internet marketing. 1 lecture, 3 activities. Prerequisite: Third-year standing or permission of instructor.

EDES 350 The Global Environment (4)  GE Area F (Also listed as AG/BUS/ENGR/HUM/SCM/UNIV 350)
Interdisciplinary investigation of how human activities impact the Earth’s environment on a global scale. Examination of population, resource use, climate change, and biodiversity from scientific/technical and social/economic/historical/political perspectives. Use of remote sensing maps. Sustainable solutions. 3 lectures, 1 activity. Prerequisite: Completion of GE Areas A and B and junior standing.

EDES 406 Sustainable Environments (4)
Collaboration of interdisciplinary faculty and guest speakers/panelists. Introduction, illustration and analysis of concepts and principles for sustainability to be used in all aspects of environmental design. Integration and application of knowledge of human and natural systems with environmental, social and economic concerns, from a global-to-local perspective. 4 lectures. Prerequisite: Fourth year or graduate standing, or consent of instructor.

EDES 408 Implementing Sustainable Principles (4)
A primarily project-based course, intended to aid students who wish to collaborate with the purpose of implementing sustainability principles by developing tools, process or designs, for community-based projects and proposals at various scales of planning, architecture and design of the human environment to address social, environmental and economic issues. 4 lectures. Prerequisite: EDES 406 or consent of instructor.

EDES 410 Advanced Implementation of Sustainable Principles (4)
Advanced continuation of community-based projects defined and initiated in EDES 408. Ongoing projects, individual and group, address variable scales of planning, architecture, and environmental design, with required completion at the end of the course. 2 seminars and supervised work. Prerequisite: EDES 408.

EDES 420 Historic Preservation and Adaptive Reuse in the Built Environment (4)
Historic preservation, restoration, and rehabilitation issues in the built environment. Focus on the process and issues of preserving cultural heritage through preserving environmental artifacts (i.e., structure and landscape). The importance of preserving historical districts, buildings and landscapes as well as techniques for accomplishing preservation goals within the existing regulatory environments. Total credit limited to 8 units. 2 lectures, 2 seminars. Prerequisite: Any GE Area D course or consent of instructor.

EDES 430 Collaborative Process (3)  (Also listed as CM 430)
A comprehensive set of tools and practices that allow for high performance, interdisciplinary collaborative teams to focus on extraordinary outcomes at each step of project development, including planning, design, bidding, permitting, construction and management phases. 3 activities. Prerequisite: Third-year standing or consent of instructor.

EDES 431 Integrated Project Services (3)  (Also listed as CM 431)
Overview of project delivery methods with an emphasis on trends in integrated services project delivery. Integrated services entity organization structures, process variations, procurement and selection methodologies. Integration of planning, design and construction efforts to achieve maximum project quality and value. 3 laboratories. Prerequisite: Fourth-year standing.

**EDUC–EDUCATION**

EDUC 125 First Year Seminar (2) (CR/NC)
Issues associated with the successful transition from high school or community college to Cal Poly. Links fostered between student needs and campus resources. Coverage of academic policies and procedures, university study skills, goal setting, career planning, wellness and other topics relevant to student success. Credit/No Credit grading only. 1 lecture, 1 activity.

EDUC 207 The Learner's Development, Culture and Identity in Educational Settings (4)  (Also listed as CD 207)
Theoretical background of child and early adolescent development within diverse cultural settings and implications for the teaching-learning process. Observations of children in everyday settings. 3 lectures, 1 activity. Prerequisite: PSY 201 or PSY 202.

EDUC 300 Introduction to the Teaching Profession (3)  (CR/NC)
Supervised observation and participation in cooperating public schools. A minimum of forty-five hours of observation and participation. Discussion focuses on instructional practice and subject matter taught in grades observed, as well as the historical, philosophical, and social foundation of American public education. Total credit limited to 6 units. Credit/No Credit grading only. 2 lectures, 1 activity. Prerequisite: Junior standing or consent of instructor.

EDUC 304 Orientation to the Teaching of Students with Disabilities (2)  (CR/NC)
Introduction to the Education Specialist Credential and role of special education in the public school. Required first course in program. Orientation to program and study of self and others, laws and current conditions of special education. Required field observations and activities. 1 seminar, 1 activity. Credit/No Credit grading only. Prerequisite: Acceptance into Level I Special Education Credential Program, and must have fulfilled field experience requirement.

EDUC 310 Effective Teaching and Classroom Management with a Multicultural Perspective in K-3 and 4-8 Settings (4)
Knowledge, theory, fieldwork and research related to effectively managing, planning, and teaching in K-3 and 4-8 classrooms; connections between preventing discipline problems and choices about curriculum, instruction, and management; creating a positive learning environment for all students. 2 seminars, 2 activities. Prerequisite: Completion of GE Area A.

EDUC 400 Special Problems for Undergraduates (1-4)
Individual investigation, research, studies or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter. Prerequisite: Junior standing and consent of instructor.

EDUC 412 Schooling in a Democratic Society (4)  (CR/NC)
The role and aims of public education for culturally diverse learners. Credit/No Credit grading only. 2 lectures, 2 activities. Prerequisite: Admission to the Single Subject Program or senior standing for Agricultural Education candidates. Concurrent: EDUC 414 and EDUC 416 and content methods course (except students enrolled in Agricultural Education Credential Program). Changed effective Fall 2008; see Updates.