
445: Legal Aspects of Government and Business. 0-3-3. Prereq., BLAW 255 or special permission of the instructor. A study of landmark law cases with special emphasis placed on guideline interpretive decisions of significance to management.


213: Unit Operations-Design I. 0-3-3. Prereq., CMEN 202, 254, MATH 244. Design procedures for equipment and processes involving fluid flow and fluid mixing, with emphasis on computer assisted design techniques.

254: Laboratory Measurements and Report Writing. 3-0-1. Prereq., CMEN 202 and completion of integrated freshman engineering curriculum. A study of applied analytical and statistical procedures and measurement of process variables in chemical processing and an introduction to technical report writing.

304: Transport Phenomena. 0-3-3. Prereq., CMEN 213, 313, 413, MATH 245. Fundamental principles of energy, mass, and momentum transfer and transport processes.

313: Unit Operations-Design II. 0-3-3. Prereq., CMEN 213 or consent of instructor. Design procedures for equipment and processes involving heat transfer, with emphasis on computer assisted design techniques.


353: Chemical Engineering Junior Laboratory. 3-0-1. Prereq., CMEN 254, 313, and ENGL 303. Laboratory study of fluid phenomena, heat transfer processes and equipment, and evaporation.

402: Chemical Reaction Engineering. 0-3-3. Prereq., CHEM 312; senior standing in CMEN. Homogeneous and heterogeneous chemical reaction kinetics, applications to ideal and real reactor types. (G)

407: Instrumentation and Automatic Process Control. 3-2-3. Prereq., senior standing in CMEN. Survey of process instrumentation methods, and the analysis and design of feedback, feed forward, and cascade control systems. (G)

408: Pulp and Paper Processes. 0-3-3. Prereq., senior standing in CMEN. Introduction to the pulp and paper industry, its terminology, technology and economics. Conversion of various cellulosic materials into unbleached pulp and paper products. (G)

411: Environmental Chemodynamics. 0-3-3. Prereq., CMEN 413 and senior standing in CMEN. A study of the modeling and prediction of the movement and fate of synthetic chemicals in the air-water-earth environment. Cross-listed with CMEN 411. (G)

413: Unit Operations-Design III. 0-3-3. Prereq., CMEN 313. Application of design procedures for equipment and processes involving evaporation, distillation, leaching, extraction, gas absorption and desorption, with emphasis on computer assisted design techniques.

415: Theory and Practice of Radiation Protection and Shielding. 0-3-3. Prereq., senior standing. An introduction to principles of dosimetry. The concepts of probability of causation, risk assessment, and methods of establishing exposure limits will be discussed. (G)


432: Chemical Plant Design II. 0-2-2. Prereq., senior standing in CMEN and CMEN 430. Comprehensive problems are assigned, the solution of which enables the student to calculate dimensions and capacities of required plant equipment. Computer applications.


435: Polymer Engineering. 0-3-3. Prereq., Senior standing in CMEN or consent of the instructor. Polymer technology and processes including polymer structure, states, and transitions; kinetics of polymerization; molecular weight determination; viscous flow; mechanical properties; polymer degradation; analysis and identification. (G)

442: Process Optimization. 0-3-3. Prereq., senior standing in CMEN. An objective study of the present status of optimization methodology as applied to the chemical process industries. Both deterministic and non-deterministic systems are considered. (G)

443: Air Pollution Control Design. 0-3-3. Prereq., Senior standing in CMEN or consent of instructor. An overview of the air pollution problem. Design of devices to control emissions (VOCs, NOx, SO2, particulates, etc.) Cost estimation of air pollution control systems. (G)

450: Special Problems. 1-4 semester hours credit. Prereq., senior standing in CMEN. Problems covering selected topics of current importance or special interest or need. (G)

451: Senior Chemical Engineering Laboratory. 6-0-2. Prereq., CMEN 353 and 413 or consent of instructor. Laboratory work in humidification, drying, distillation, absorption, extraction, and kinetics.

452: Special Projects Laboratory. 1 hour credit. Prereq., senior standing in CMEN. Selected comprehensive problems. Studies and/or laboratory development of: industrial unit operations; new chemical processes; improvement of established processes; economic evaluations. Theoretical studies.

455: Biochemical Engineering. 0-3-3. Prereq., CMEN 402 or consent of instructor. Introduction to biotechnology and bioprocesses. Microbiology and biochemical processes are reviewed. Enzyme kinetics, microbial growth transport phenomena, and design of biochemical reactors are studied. Cross-listed with BIEN 455. (G)

456: Hazardous Waste Management. 0-3-3. Prereq., senior standing in CMEN. A study of the legislation, regulation, technology, and business matters relating to hazardous waste management. (G)

475: Combustion, Fires and Explosions. 0-3-3. Prereq., senior standing in CMEN. Nature of combustion, controlled and free burning fires, and evaluation of explosion hazards. (G)

501: Advanced Unit Operations. 0-3-3. Design calculations applicable to various unit operations including drying, humidification, absorption, adsorption, distillation, heat exchangers, ion exchange, cooling towers and filtration.


513: Transport Phenomena. 0-3-3. A course in which advanced concepts on momentum, energy, and mass transport is explored. Emphasis is placed on unsteady state behavior, turbulence, and recent developments in the literature.

521: Energy Analysis of Industrial Processes. 0-3-3. Prereq., An undergraduate course in thermodynamics. The application of the concept of exergy, or energy availability, to the systematic analysis of processes and plants to make most efficient use of limited energy resources.

522: Advanced Thermodynamics. 0-3-3. The relations of thermodynamic properties are developed. Problems on the expansion and compression of non-gases, liquefaction, low temperature separation are studied.

524: Seminar. 0-1-1. Each. Surveys, investigations, and discussions of current problems in Chemical Engineering.

550: Special Problems. 1-4 semester hours. Prereq., consent of instructor. Selected topics dealing with advanced problems in chemical engineering and design of equipment. The problems and projects will be treated by current methods used in professional practice.

551: Research and Thesis in Chemical Engineering. Registration in any quarter may be for three semester hours credit or multiples thereof. Maximum credit allowed is six semester hours.

555: Practicum. 0-3-3 (6). Prereq., 12 semester hours of graduate work. Analytical and/or experimental solution of an engineering problem; technical literature survey required; development of engineering research techniques.

557: Special Topics: Chemical Engineering. 0-3-3 (9). The topic or topics will be selected by the instructor from the various sub-areas of chemical engineering. May be repeated as topics change.

CHEMISTRY (CHEM)

100: General Chemistry. 0-2-2. Prereq., or Coreq., MATH 101 or 111, or 240. Fundamental principles of chemistry; Chemistry and measurement, atomic symbols and chemical formulas, stoichiometry, gases and thermochemistry.

101: General Chemistry. 0-2-2. Prereq., CHEM 100. Continuation of CHEM 100: Atomic and molecular structure, theories of molecular bonding, liquids, solids and solutions.

102: General Chemistry. 0-2-2. Prereq., CHEM 101. Continuation of CHEM 101: Rates of reaction, study of chemical equilibria including those
involving acids, bases, sparingly soluble salts and complex ions, thermodynamics of equilibrium and introductory electrochemistry.

103: General Chemistry Laboratory. 4 1/4-0-1. Coreq., CHEM 101. Laboratory practice in general chemistry.

104: General Chemistry Laboratory. 4 1/4-0-1. Preq., CHEM 103. Continuation of CHEM 103.

107: General Chemistry. 0-3-3. Preq., or Coreq., MATH 101, or 111, or 240. Fundamental principles of chemistry; chemistry and measurement, atomic symbols and chemical formulas, stoichiometry, gases and thermochemistry. Atomic and molecular structure, theories of molecular bonding.


120: An Introduction to Inorganic Chemistry. 0-3-3. Topics covered will include scientific units, states of matter, the electronic structure of atoms, the chemical bond, solutions, reaction kinetics, acid-base theory, and buffers.

121: An Introduction to Organic Chemistry and Biochemistry. 0-3-3. Preq., CHEM 120 or 102. Survey of hydrocarbons and their derivatives; biomolecules including proteins, sugars, lipids, and nucleic acids. Not to be used as a prerequisite for advanced chemistry courses.

122: Chemistry Laboratory. 4-0-1. Preq., CHEM 120. Basic laboratory experience in inorganic, organic, and biochemistry.

205: Analytical Chemistry. 4 1/4-3-4. Preq., CHEM 102. Theory and practice of analytical Chemistry.

250: Organic Chemistry. 0-2-2. Preq., CHEM 102. Introduction to organic chemistry with emphasis on structure and reactivity of aliphatic hydrocarbons and alky1 halides.


252: Organic Chemistry. 0-2-2. Preq., CHEM 251; Coreq., CHEM 254. Continuation of CHEM 251 with emphasis on carbonyl compounds, aliphatic and aromatic amines, phenols, carbohydrates and related reaction mechanisms.

253: Organic Chemistry Laboratory. 4 1/4-0-1. Preq., CHEM 102; Coreq., CHEM 251. Selected experiments emphasizing both laboratory operations and related basic principles and mechanisms.

254: Organic Chemistry Laboratory. 4 1/4-0-1. Preq., CHEM 253; Coreq., CHEM 252. Introduction to multi-step organic syntheses and related reaction mechanisms.

281: Inorganic Chemistry. 4 1/2-2-3. Preq., CHEM 102 and 104. Introduction to inorganic chemistry, including a systematic study of the periodic table with emphasis on structure, properties and reactivity of the elements of inorganic compounds.

301: Introductory Physical Chemistry. 0-3-3. Preq., CHEM 102 and MATH 112 or 241. An introduction to physical chemistry, with emphasis on properties of gases, thermodynamics, chemical equilibrium, ionic equilibria, chemical kinetics, and molecular spectroscopy.

311: Physical Chemistry. 0-3-3. Preq., CHEM 102 and 252, MATH 231 and PHYS 202 or 209. Basic theories of chemistry with emphasis on gases, chemical thermodynamics and phase equilibria.

312: Physical Chemistry. 0-3-3. Preq., CHEM 311. Basic theories of chemistry with emphasis on chemical kinetics, quantum theory, statistical thermodynamics and molecular spectroscopy.

313: Physical Chemistry Laboratory. 4 1/4-0-1. Coreq., CHEM 311. Laboratory experiments in physical chemistry.

314: Physical Chemistry Laboratory. 4 1/4-0-1. Preq., CHEM 311; Coreq., CHEM 312. Continuation of CHEM 313.

351: Biochemistry. 0-3-3. Preq., CHEM 252, 254. The chemistry of biologically important compounds including fats, carbohydrates, proteins, enzymes, vitamins, and hormones.


353: Biochemistry Laboratory. 4 1/4-0-1. Coreq., CHEM 351. Techniques applicable to current biochemistry with emphasis on basic research procedures.

354: Biochemistry Laboratory. 4 1/4-0-1. Preq., CHEM 351 and CHEM 353. Techniques applicable to current biochemistry with emphasis on metabolism and molecular biology.

409: Advanced Organic Chemistry. 0-3-3. Preq., CHEM 381 and 312. Introduction to theoretical organic chemistry with emphasis on carbocation chemistry and pericyclic reactions.

420: Chemical Thermodynamics. 0-3-3. Preq., CHEM 312. An introduction to chemical thermodynamics.

424: Advanced Physical Chemistry. 0-3-3. CHEM 312 or PHYS 410 and MATH 245. A continuation of CHEM 311-312, including an introduction to quantum chemistry, and a quantum mechanical approach to the study of the structure of atoms and molecules.

450: Chemical Topics. 1-4 hour(s) credit (8). Preq., CHEM 3 12 and consent of instructor. An opportunity to observe and discuss topics of current interest in the chemical sciences. Offered on demand.

466: Instrumental Analysis. 8 1/2-2-4. Preq., CHEM 312. Theory and practice of optical methods of analysis, advanced electrical techniques, and modern separation methods. (G)

470: Methods, Materials and Activities for Teaching Chemistry. 0-3-3. Preq., CHEM 102 and instructor permission. A course especially designed for the high school chemistry instructor.

471: Methods, Materials and Activities for Teaching Chemistry. 4 1/2-3-4. Preq., CHEM 102 and instructor's permission. A continuation of CHEM 470.

481: Advanced Inorganic Chemistry. 4 1/2-2-3. Preq., CHEM 252, 312. An advanced study of the periodic classification of elements, their reactions, and other inorganic principles. (G)

490: Chemistry Seminar. 0-1-1 (3). Preq., Senior or graduate standing. Required of chemistry graduate students. Supervised organization and presentation of topics from the chemical literature. (G)

498: Undergraduate Research. 1-3 hours credit (6). Preq., consent of instructor. Introduction to methods of research and completion of a basic research problem.


502: Selected Topics in Organic Chemistry. 0-3-3 (6). Preq., CHEM 409. Areas covered will vary; however they will generally include advanced organic synthesis and related structure identification with emphasis on spectroscopic techniques.

503: Topics in Chemistry. 1-3 hours credit (6). Independent study. Topics arranged to meet the needs of the student.


523: Special Topics in Physical Chemistry. 0-3-3. Preq., CHEM 312. Topics will vary and will include kinetic theory of gases, molecular structure, phase rule, photochemistry, nuclear chemistry, chemical kinetics, or statistical thermodynamics.

524: Quantum Chemistry. 0-3-3. Preq., CHEM 312 or PHYS 410. Physical and chemical applications of quantum theory.

549: Practicum in Chemistry. 0-3-3 (6). Preq., 12 semester hours of graduate work. Experimental or computational study of a problem in chemistry. A survey of the relevant literature and a formal written report are required.

551: Research and Thesis in Chemistry. Registration in any quarter may be for three-quarter hours credit or multiples thereof. Maximum credit allowed is six semester hours.

555: Special Topics in Biochemistry. 0-3-3 (9). Preq., CHEM 352. Topics covered will vary and may include toxicology and clinical biochemistry.

566: Protein Chemistry. 0-3-3. Preq., CHEM 351. The chemical nature and physiology of both structural and metabolic proteins.

563: Advanced Analytical Chemistry. 0-3-3. Preq., CHEM 466. Theoretical aspects of the optical, chemical, and separation techniques of analytical chemistry.

564: Selected Topics in Analytical Chemistry. 0-3-3. The topic or topics will be selected in the general areas of chemical separations or spectroscopy by the instructor. (TECH-NLU Collaborative).

584: Chemistry of Coordination Compounds. 0-3-3. Preq., CHEM 481. A study of the structure, preparation, and properties of coordination compounds.

586: Special Topics in Inorganic Chemistry. 0-3-3. Preq., CHEM 584 or instructor's permission. A topic will be selected on a rotating basis from the following: magnetic and electric properties, solid state structures, catalysis, and group theory applications of inorganic materials.
### Civil Engineering (CVEN)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>202</td>
<td>Civil Engineering Materials Laboratory</td>
<td>4-0-1</td>
<td>Coreq., concurrent with MGMT 201</td>
<td>Introduction to laboratory testing of aggregates, concrete, asphalt, steel, and other materials used by civil engineers.</td>
</tr>
<tr>
<td>254</td>
<td>Plane Surveying</td>
<td>4-2-3</td>
<td>Preq., MATH 112 or 240, Theory, field measurements, and computation and error analysis associated with land, traverse, and topographic surveys.</td>
<td></td>
</tr>
<tr>
<td>291</td>
<td>Civil Engineering Computations</td>
<td>3-1-2</td>
<td>Preq., MATH 241</td>
<td>Application of microcomputers in civil engineering. Numerical techniques and statistical applications, personal productivity tools, application software.</td>
</tr>
<tr>
<td>300</td>
<td>The Civil Engineering Profession</td>
<td>0-3-3</td>
<td>Preq., sophomore standing</td>
<td>Open only to civil engineering students. The civil engineering profession and its effect on society. History and heritage, current professional practices and techniques, concepts and challenges for the future.</td>
</tr>
<tr>
<td>310</td>
<td>Water Resources I</td>
<td>0-3-3</td>
<td>Preq., MGMT 313</td>
<td>Hydrologic and hydraulic analysis of precipitation and runoff, storm water management, detention basin design, and flood frequency analysis.</td>
</tr>
<tr>
<td>314</td>
<td>Environmental Engineering</td>
<td>3-2-3</td>
<td>Preq., ENGL 303, CHEM 103</td>
<td>Measurements and mapping from aerial photographs. Hydrologic and hydraulic analysis of precipitation and runoff, storm water management, detention basin design, and flood frequency analysis.</td>
</tr>
<tr>
<td>324</td>
<td>An Introduction to Soils Engineering</td>
<td>0-3-3</td>
<td>Preq., MGMT 211</td>
<td>Introduction to soil mechanics and its application to civil engineering. A presentation of soil properties and characteristics pertinent to an evaluation of various engineering situations, problems and designs.</td>
</tr>
<tr>
<td>325</td>
<td>Introduction to Foundation Engineering</td>
<td>0-3-3</td>
<td>Preq., CVEN 324</td>
<td>Consideration of bearing capacity, settlement of structures, slope stability, foundation design requirements, subsurface exploration, regional soil conditions, footings, mats, and retaining walls.</td>
</tr>
<tr>
<td>332</td>
<td>Transportation Engineering I</td>
<td>0-3-3</td>
<td>Preq., ENGR 122</td>
<td>Introduction to transportation facilities; urban transportation planning; traffic, design, safety, and the environment.</td>
</tr>
<tr>
<td>333</td>
<td>Transportation Engineering II</td>
<td>3-2-3</td>
<td>Preq., CVEN 332</td>
<td>Design of highway and airport runaway elements in a laboratory and field environment.</td>
</tr>
<tr>
<td>341</td>
<td>Steel &amp; Reinforced Concrete Design</td>
<td>3-2-3</td>
<td>Preq., CVEN 340</td>
<td>Design of steel and reinforced concrete structures with emphasis on behavior of tension and compression members, beams, and slabs. Steel connections in elementary structures.</td>
</tr>
<tr>
<td>355</td>
<td>Advanced Surveying</td>
<td>4-2-3</td>
<td>Preq., CVEN 254</td>
<td>Advance error propagation theory, including an introduction to least squares. Various horizontal/vertical high precision surveys; geodetic concepts and surveys; Global Positioning Systems.</td>
</tr>
<tr>
<td>357</td>
<td>Engineering and Construction Surveying</td>
<td>4-1-2</td>
<td>Preq., CVEN 254</td>
<td>Horizontal/vertical curves; earthwork; topographic/planimetric surveys for map/drawing construction; engineering use of State Plane Coordinate System; surveys for buildings, pipelines, and others.</td>
</tr>
<tr>
<td>401</td>
<td>Air Pollution Fundamentals</td>
<td>0-3-3</td>
<td>Preq., Senior standing in an engineering curriculum, or consent of instructor. History of air pollution legislation, sources, and effects of major air pollutants, and predictive capabilities with regard to air pollution.</td>
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<tr>
<td>412</td>
<td>Environmental Impact Analysis</td>
<td>0-3-3</td>
<td>Preq., Senior standing in Civil Engineering or the consent of the instructor. Definition and quantification of environmental impact. Types of environmental impact studies.</td>
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</tr>
<tr>
<td>414</td>
<td>Bituminous Mixture Design</td>
<td>3-2-3</td>
<td>Preq., senior standing, Selection of binders and aggregates for mixture design processes. Methods include Marshall, Hveem and SUPERPAVE. Laboratory mixes will be designated and tested.</td>
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</tr>
</tbody>
</table>

### Additional Courses

417: Groundwater Hydrology. 0-3-3. Preq., CVEN 310. Groundwater occurrence, movement and quality, well hydraulics, basin development, and model studies. (G)


422: Geometric Design. 0-3-3. Preq., CVEN 332. Functional design of highways, railroads and runways with emphasis on safety and efficiency of flow set intersections, curves, and interchanges. (G)

423: Introduction to Asphalt Technology. 3-2-3. Preq., senior standing, or consent of instructor. Production and uses of asphalt; measurement and significance of laboratory properties including viscosity, penetration, flash point, ductility, solubility, thin film oven test and specific gravity. (G)

424: Seminar. 0-1-1. Preq. Senior standing. Reading and discussion of assigned papers, informal talks by instructors and professional engineers, debates on matters of current interest. |

425: Traffic Engineering. 0-3-3. Preq., CVEN 332. Traffic characteristics, vehicle operating characteristics, traffic control, and design of traffic facilities. Basic traffic studies, capacity, signing and signalization, speed regulation and parking. (G)

427: Design of Highway Pavements. 0-3-3. Preq., CVEN 324. Flexible and rigid pavement types. Factors affecting stresses and strains in pavement layers. Design criteria and structural design methods for highway pavements. (G)

436: Construction Equipment and Methods. 0-3-3. Preq., Junior standing, and ENGR 122 or INEN 300. Study of economics and functional applications of construction equipment. Operation characteristics are identified for selected equipment items, and are applied to typical construction situations. (G)

437: Contracts and Specifications. 0-2-2. Preq., CVEN 439. Legal documentation of construction contracts. (G)


439: Construction Planning, Contracts and Specifications. 0-3-3. Preq., Junior standing and either INEN 300 or ENGR 122. Introduction to methods for planning, estimating, and controlling projects, construction contracts, specifications and cost impacts. Term projects required. Team efforts on problems and case studies. (G)

440: Foundation Engineering. 0-3-3. Preq., CVEN 325 or consent of instructor. Theory and applications in foundation engineering design; application of soil mechanics. (G)

443: Analysis of Continuous Structures. 0-3-3. Preq., CVEN 340; Slope-deflection, moment distribution plastic design, matrix applications, STRUDL language. (G)

450: Special Problems. 1-4 hours credit. Preq., senior standing and consent of instructor. Planning, organization, and solution of problems in Civil Engineering. (G)

456: Legal Aspects of Boundary Surveying. 0-3-3. Preq., CVEN 254 or consent of instructor. Legal aspects of various boundary systems. Legal principles of boundary surveys: common statute law, written/unwritten rights and rules of evidence, property descriptions/layout. (G)

457: Practical Surveying. 40-0-3. Preq., CVEN 355, 357, or 456. An on-the-job training program; student is employed by registered professional surveyor for 300 working hours (minimum); work to be approved by program chair. (G)

458: Introduction to Geographic Information Systems. 0-3-3. Preq., senior standing, or approval of instructor. Basic principles, functions, and engineering applications of spatial information systems; introduction to databases. Team case studies using GIS software. (G)

459: Introduction to Infrastructure Management. 0-3-3. Preq., junior standing. Lifecycle approach to planning, designing, and managing infrastructure (highways, streets, utilities); infrastructure decision support systems; performance measures and prediction; computer applications; case studies. (G)

464: Advanced Design of Concrete Structures. 0-3-3. Preq., CVEN 341. Advanced topics in the design of reinforced and prestressed concrete structures. (G)

466: Advanced Structural Design. 0-3-3. Preq., CVEN 341. Advanced topics in the design of steel and timber structures. Load and resistance factor design. (G)
structures. Finite element method. Structural optimization. Introduction to the use of computational techniques for designing structures with minimal ground surface disturbance. Open-ended design problems typical of those encountered in the Civil Engineering profession and calling for the integration of geotechnical, structures, transportation and water resources. Computational Structural Design. 0-3-3. Preq., CVEN 341. An introduction to the use of computational techniques for designing structures. Finite element method. Structural optimization. (G)

Introduction to Trenchless Technology. 0-3-3. Preq., MEMT 313. Basic technologies, design considerations and construction practices for underground infrastructure construction and rehabilitation. Civil Engineering Design I. 3-0-1. Preq., senior standing and within 3 quarters of graduation. Open-ended design problems typical of those encountered in the Civil Engineering profession and calling for the integration of geotechnical, structures, transportation and water resources.

Civil Engineering Design II. 3-0-1. Preq., Coreq., CVEN 492. A continuation of CVEN 492.


Computer-Aided Civil Engineering Design. 4-2-3. Preq., Senior standing in Civil Engineering or consent of instructor. Integration of computers in civil engineering design applications. Emphasis is on design of temporary structures. Specific software applications vary. (G)


Dynamic Analysis of Structures. 0-3-3. Preq., MATH 245. Analysis of structures (SDOF and MDOF) under wind, wave, earthquake and impact forces.


Bituminous Mixture Design. 3-2-3. Selection of binders and aggregates for mixture design processes. Methods include Marshall, Hvem and SUPERPAVE. Laboratory mixes will be designed and tested.

Advanced Pavement Design. 0-3-3. Preq., CVEN 427 or consent of instructor. Traffic and loading considerations for airfield pavements. Structural design methods for highway and airfield pavements, with emphasis on computerized design and analysis techniques.

Techniques for Pavement Rehabilitation. 0-3-3. Evaluation of roadway distress, roughness, friction, drainage and structural surveys will be discussed. Survey results used to identify cost-effective techniques for pavement rehabilitation.

Design of Temporary Structures. 0-3-3. Advanced topics in the design of temporary structures required for complex construction projects.


Contaminant Transport. 0-3-3. Preq., CVEN 314, 310, or consent of instructor. Mathematical modeling of contaminant transport in surface and ground water systems.


Special Problems. 1-4 hours credit. Advanced problems in Civil Engineering will be assigned according to the ability and requirements of the student. An opportunity will be afforded to plan, organize, and complete solutions in problems of considerable magnitude with a view toward developing confidence and self-reliance.

Research and Thesis in Civil Engineering. Registration in any quarter may be for three semester hours credit or multiples thereof. Maximum credit allowed is six semester hours.

Research and Communications Seminar. 0-3-3. Preq., 12 semester hours of graduate work. Oral and written communication of literature search.

Special Topics: Civil Engineering. 0-3-3 (9). The topic or topics will be selected by the instructor from the various sub-areas of civil engineering. May be repeated as topics change.
460: Clinical Hematology. 2-6 semester credit hours. Preq., consent of instructor. Advanced concepts in the theory, application and medical interpretation of hematological and hemostatic mechanisms and methods.

461: Clinical Hematology Laboratory. 1-5 semester credit hours. Preq., consent of instructor. Instruction and laboratory practice in the development and use of advanced analytical procedures and instrumentation in clinical hematology and hemostasis.

462: Clinical Serology and Immunology. 1-4 semester credit hours. Preq., consent of instructor. Advanced concepts in the theory, application and medical interpretation of serological and immunological mechanisms and methods.

463: Clinical Serology and Immunology Laboratory. 1-4 semester hours credit. Preq., consent of instructor. Practical instruction and laboratory practice in the performance of serological and immunological procedures.

464: Clinical Bacteriology. 2-5 semester credit hours. Preq., consent of the instructor. Advanced concepts in the use and interpretation of medical bacteriological procedures and data.

465: Clinical Bacteriology Laboratory. 3-6 semester credit hours. Preq., consent of the instructor. Instruction and laboratory practice in the performance of manual clinical chemistry procedures and instrumentation in clinical bacteriology.

466: Clinical Immunohematology. 1-4 semester credit hours. Preq., consent of the instructor. An advanced study of the principles of immunohematology necessary to provide a patient with a safe blood transfusion.

467: Clinical Immunohematology Laboratory. 1-4 semester credit hours. Preq., consent of the instructor. Practical instruction and laboratory practice in immunohematological procedures utilized in a hospital blood bank.

468: Clinical Chemistry. 3-6 semester credit hours. Preq., consent of the instructor. Advanced concepts in the theory application, and medical interpretation of clinical biochemical mechanisms and methods.


470: Special Clinical Chemistry Laboratory. 1-3 semester credit hours. Preq., consent of instructor. Practical instruction and laboratory practice in the performance of special clinical chemistry procedures.

471: Automated Clinical Chemistry Lab. 1-2 semester credit hours. Preq., consent of instructor. Practical instruction and lab practices in the performance of automated clinical chemistry procedures.

472: Clinical Chemistry Toxicology Laboratory. 1-2 semester credit hours. Preq., consent of instructor Practical instruction and laboratory practice in the performance of toxicological procedures.

473: Clinical Chemistry Radioimmunoassy Laboratory. 1 semester credit hour. Preq., consent of instructor. Practical instruction and laboratory practice in the performance of radioimmunoassay procedures.

474: Clinical Urinalysis. 1-3 semester credit hours. Preq., consent of instructor. Advanced concepts in the use and interpretation of urinalysis procedures and data.

475: Clinical Urinalysis Laboratory. 1-3 semester credit hours. Preq., consent of instructor. Practical instruction and laboratory practice in the performance of urinalysis procedures.

476: Clinical Parasitology, Mycology and Mycobacteriology. 1-2 semester credit hours. Preq., consent of instructor. Advanced concepts in the use and interpretation of procedures and data in clinical parasitology, mycology, and mycobacteriology.

477: Clinical Parasitology, Mycology and Mycobacteriology Laboratory. 1-2 semester credit hours. Preq., consent of instructor. Instruction in laboratory practice in the development and use of advanced analytical procedures in clinical mycology, parasitology, and mycobacteriology.

478: Clinical Laboratory Administration. 1-2 semester credit hours. Preq., consent of instructor. Modern management concepts for the clinical laboratory.

479: Clinical Histopathology. 1-5 semester credit hours. Preq., consent of instructor. Advanced concepts in the use and interpretation of histotechnological procedures and findings.

480: Clinical Medical Technology Problems. 1-8 semester credit hours. Preq., consent of instructor. An introduction to emerging medical technologies.

483: Clinical Parasitology. 1-2 semester credit hours. Identification, clinical significance, and methods of prevention of parasitic infections.

484: Clinical Parasitology Laboratory. 1-2 semester credit hours. Instruction and laboratory practice in the development and application of medical parasitology laboratory methods.

485: Clinical Mycology. 1-2 semester credit hours. Identification, clinical significance and methods of prevention of mycotic infection.

486: Clinical Phlebotomy and Specimen Procurement. 1-3 semester credit hours. Preq., consent of instructor. Instruction and laboratory practice in phlebotomy and the collection of other specimens for clinical analysis. Specimen preservation and safe lab practices are included.

487: Clinical Hemostasis. 1-4 semester hours credit. Preq. consent of instructor. The theory of the coagulation cascade, analytical procedures that monitor this process and the clinical significance of coagulopathies are discussed.

488: Clinical Hemostasis Laboratory. 1-4 semester credit hours. Laboratory procedures which assess the coagulation cascade and related processes.

489: Clinical Chemistry Laboratory. 3-8 semester hours credit. Practical instruction and laboratory practice in clinical chemistry procedures, including associated instrumental analysis.

102: Typewritten Communication. 0-3-3. Preq., Basic knowledge in typewriting/keyboarding. Emphasis on formatting and production of typewritten communications including business forms, internal and external correspondence. (Meets intermediate typewriting requirements for Business Education majors.)


310: Principles of Information Systems. 0-3-3. Preq., CIS 110, junior standing. Introduction to concepts and principles of information system resources, analysis, development, management, and applications.


335: Application Development for the Internet. 0-3-3. Preq., CIS 310, 339. Programming for Internet- and Intranet-based business applications. The principles of good software engineering and program clarity will be stressed.


401: Internship in CIS I. 3 hours credit. (Pass/Fail) Preq. consent of instructor and senior standing. On site, supervised, structured work experiences in the field of business.

402: Internship in CIS II. 3 hours credit. (Pass/Fail) Preq. consent of instructor and senior standing. On site, supervised, structured work experiences in the field of business.

444: Network Design & Implementation. 0-3-3. Preq., CIS 310, 339. Issues of designing, implementing, and managing computer networks, including both Local Area Networks (LANs) and Wide Area Networks (WANs).


510: Information Resource Management. 0-3-3. Attention is given to strategic implementation of technology, secure and effective systems, externally focused systems, along with the historical and social environment of information systems.

515: Decision Support Systems. 0-3-3. Information technology in the firm and non-profit organization with a focus on using computers, data bases, knowledge bases, graphics, and models to support decision making.


550: Directed Study in Computer Information Systems. 1-3 hours credit. Hours and credits to be arranged. Consent of instructor and approval of department head required. Special problem or specific area of computer information systems.

615: Decision Support Systems. 0-3-3. Requires Doctoral standing. May require additional class meetings. Information technology in the firm and non-profit organization with a focus on using computers, data bases,
knowledge bases, graphics, and models to support decision making. Credit will not be given for CIS 615 if credit is given for CIS 515.

625: Information Systems Project Management. 0-3-3. Preq., DBA student or consent of instructor. Intensive review of theories and literature on information systems (IS) project development and management. IS project management techniques and managerial issues will be examined. A research project proposal in IS management will be developed and completed.

630: Seminar in Computer Information Systems. 0-3-3. Study of current topics in the discipline of Computer Information Systems. In-depth analysis of a specialized research field along with an investigation of the literature. May require additional class meetings. Study of the development and application of Expert Systems and use of development shells. Topics include: Knowledge Acquisition, System Development, and Validation/Verification. Credit will not be given for CIS 635 is credit is given for CIS 535.

650: Directed Study in Computer Information Systems. 1-3 hours credit. Hours and credits to be arranged. Consent of instructor and approval of department head required. Special problem or specific area of computer information systems.

685: Comprehensive Exam in Computer Information Systems. No credit. Doctoral standing required. Required for all business administration doctoral students seeking to take the comprehensive exam in CIS. Successful completion is a prerequisite to the oral comprehensive exam for those seeking a primary field or examined minor in CIS. Requires consent of graduate director.

100: Overview of Computer Science. 0-3-3. Preq., MATH 101 or equivalent. An overview of the field of computing; history, impact on society, and current trends; together with an introduction to operating systems, editors, and rudimentary programming.

102: Programming with FORTRAN. 0-3-3. Preq., Eligible for MATH 111 or 240. Program analysis, algorithm development, data and control structures, and interpretation of results, with emphasis on numerical applications.

109: Computer Programming. 0-3-3. (cannot be taken for credit toward any Computer Science degree) Fundamentals of computer programming. Emphasis is placed on problem analysis, algorithm development, and data and control structures.

120: Introduction to Computer Programming. 0-3-3. Preq., CSC 100 or equivalent and MATH 111 or 240. An introduction to program development. Emphasis is placed on problem analysis, algorithm development, data and control structures.

210: Discrete Mathematics for Computer Scientists. 0-3-3. Preq., CSC 120 and MATH 112 or 241. An overview of the mathematical foundations of computing. Topics include sets, symbolic logic, relations, functions, combinatorics, induction, trees, graphs, and Boolean algebra.

220: Data Structures. 0-3-3. Preq., CSC 120. The definition, representation, and manipulation of basic data structures such as arrays, stacks, queues, trees, and graphs. Practical applications of these structures will be emphasized.

230: Software Design. 0-3-3. Preq., CSC 220. Design, construction and maintenance of large software systems. Topics include project planning, requirements analysis, software design methodologies, software implementation and testing, maintenance.


251: Computer Organization & Assembly Language. 0-3-3. Preq., CSC 220. Introduction to computer organization and operation, data representation and manipulation, assembly language programming, register level operations, peripheral device interfaces.

265: Introduction to Digital Design. 0-2-2. Preq., CSC 251; Coreq., CSC 269. Introduction to digital design techniques, Boolean algebra, combinational logic, minimization techniques, simple arithmetic circuits, programmable logic, sequential circuit design, registers and counters.

269: Digital Design Lab. 3-0-1. Coreq., CSC 265. Laboratory for digital design techniques, combinational and sequential logic design, registers and counters.


310: Theory of Computing. 0-3-3. Preq., CSC 220 and MATH 311. An overview of formal languages, the abstract models of computing capable of recognizing those languages, and the grammar used to generate them.

325: Advanced Data Structures and Algorithms. 0-3-3. Preq., CSC 220. Advanced data structures and algorithm design. Topics include specialized trees, graphs, sets and tables, advanced searching and sorting, complexity analysis, and algorithm design techniques.

330: Programming Languages. 0-3-3. Preq., CSC 240, 325. Techniques for specifying the syntax and semantics of programming languages. Language concepts; execution environments; comparative analysis of programming languages.

345: Operating Systems. 0-3-3. Preq., CSC 240 & 265. An introduction to operating systems concepts. Topics include processor management, storage management, device management, performance, security, and case studies of common operating systems.

364: Computer Architecture. 0-3-3. Preq., CSC 265 & 269. Architecture and organization of computer systems. Topics include the processor, control unit and microprogramming, computer arithmetic, memory hierarchy and memory management, input/output, instruction sets.

404: Senior Capstone. 0-3-3. Preq., CSC 325 & senior standing. This course provides a forum for discussion of the social and ethical aspects of computing. Communication skills will be emphasized through presentations and written reports.

419: Special Topics in Theory of Computing. 0-3-3. Preq., consent of instructor. Selected topics in the area of computing theory that are of current importance or special interest.

420: Design and Analysis of Algorithms. 0-3-3. Preq., CSC 325 or consent of instructor. Design and analysis of efficient algorithms. Topics include complexity data structures, advanced searching and sorting, algorithm design techniques, and complexity analysis.

425: Discrete Mathematics, Data Structures and Algorithms. 0-4-4. Preq., Consent of instructor (cannot be applied for credit toward any Computer Science degree). Mathematical foundations of computer science; definition, application and implementation of abstract data types; algorithm design and analysis techniques. (G)

429: Special Topics in Software Development. 0-3-3. Preq., consent of instructor. Selected topics in the area of software design that are of current importance or special interest.

430: Database Management Systems. 0-3-3. Preq., CSC 325 or consent of instructor. Database concepts, organizations and applications; database management systems; implementation of a simple database. (G)

436: Compiler Design. 0-3-3. Preq., CSC 310, 330 or consent of instructor. Principles of compiler design; assembler design; lexical analysis; syntax analysis; automatic parser generations; error detection and recovery. (G)

437: Programming Languages, Paradigms and Software Development. 0-4-4. Preq., CSC 425 and consent of instructor (cannot be applied for credit toward any Computer Science degree). Imperative, functional, logical and object-oriented paradigms; programming language semantics and language translation; specification, design, implementation, validation, and maintenance of large software systems. (G)

439: Special Topics in Programming Environments. 0-3-3. Preq., consent of instructor. Selected topics in the area of programming environments that are of current importance or special interest.

445: Architecture and Operating Systems; Parallel Computing. 0-4-4. Preq., CSC 425 and consent of instructor (cannot be applied for credit toward any Computer Science degree). Digital logic, instruction set architectures, microprocessor design; storage management, process synchronization and communications, device management; introduction to parallel architectures, languages and algorithms. (G)

449: Special Topics in Operating Systems. 0-3-3. Preq., consent of instructor. Selected topics in the area of operating systems that are of current importance or special interest.

450: Computer Networks. 0-3-3. Preq., CSC 345 or consent of instructor. An overview of computer networks. Topics include network topologies, layers, local area networks, and performance measurement and analysis. (G)

464: Advanced Digital Design. 0-3-3. Preq., CSC 265. Synchronous sequential circuits, FSM optimization and implementation, testing, level-mode sequential design, race and hazards, advanced ALU, programmable logic devices, CAD tools and HDLs.
466: Microprocessor Systems Design. 0-3-3. Prq., CSC 364. Microprocessor-based system design, bus design, memory systems, input/output interfacing and DMA, microprocessor-based laboratory project.

468: Introduction to VLSI. 0-3-3. Prq., CSC 265. VLSI design methodologies, fabrication and layout, combinational and sequential design in VLSI, subcell design, system design, advanced design techniques.

469: Special Topics in Computer Architecture. 0-3-3. Prq., consent of instructor. Selected topics in the area of computer architecture that are of current importance or special interest.

470: Computer Graphics. 0-3-3. Prq., CSC 325 or consent of instructor. Fundamentals of two and three dimensional computer graphics. Topics include line drawing, polygon rendering, clipping algorithms, and three dimensional transformations, and projection techniques. (G)

472: Human-Computer Interface. 0-3-3. Prq., CSC 230 and 325. Theory, design, and implementation of graphical human-computer interface strategies. Topics include interface layout, visualizing knowledge, design of user interfaces, and hypermedia/hypertext systems.

475: Artificial Intelligence. 0-3-3. Prq., CSC 330 or consent of instructor. The design and implementation of artificially intelligent programs. Topics include game playing, heuristic search, logic, knowledge representation, and reasoning strategies. Social implications are also discussed. (G)

479: Special Topics in Computer Applications. 0-3-3. Prq., consent of instructor. Selected topics in the area of computer applications that are of current importance or special interest.


499: Special Topics in Computer Science. 0-3-3. Prq., consent of instructor. Selected topics of current importance or special interest.

505: Expert Systems. 0-3-3. Prq., CSC 475 or consent of instructor. Current topics in expert system design, knowledge acquisition, explanation generation and knowledge representation. A substantial expert system design, implementation and testing project is required.

512: Programming Language Semantics. 0-3-3. Prq., CSC 310 or CSC 436 or consent of instructor. Syntax specification using attribute grammars and two level grammars, operational semantics, translational semantics, formal semantic techniques such as denotational semantics, algebraic specification, and axiomatic semantics.

520: Advanced Analysis of Algorithms and Complexity. 0-3-3. Prq., CSC 420 or consent of instructor. Formal analysis of time and space requirements of various algorithms, greedy algorithms, divide-and-conquer, dynamic programming, P and NP algorithms; Turing machines and unsolvability.

521: Advanced Computer Architectures. 0-3-3. Prq., CSC 364. Topics include: pipeline systems design, processor design techniques (concepts, analysis, performance comparison, implementation, commercial processors), memory system design, interconnection media.

530: Database Theory. 0-3-3. Prq., CSC 430 or consent of instructor. Data models, relational algebra and relational calculus, data dependencies and schema normalization, Datalog, recovery and concurrency control, distributed database environments.

532: Advanced Topics in Software Engineering. 0-3-3. Prq., CSC 230 or consent of instructor. Readings in requirements analysis, formal specification techniques, software design techniques, CASE tools, software metrics, software verification and validation, quality assurance and software safety.

534: Performance Measurement and Evaluation. 0-3-3. Prq., CSC 345 or consent of instructor. Computer systems performance; analysis techniques; data acquisition methods; simulation techniques; interpretation of results.


550: Special Problems. 1-4 semester hour credit. Individual research and investigation of a problem in computer science or computing practice.

551: Research and Thesis in Computer Science. Registration in any quarter may be for three semester hours credit or multiples thereof. Maximum credit allowed is six semester hours.

554: Advanced Networking. 0-3-3. Prq., CSC 450 or consent of instructor. May be repeated with change in subject matter. Selected research topics of current interest in the field of computer communications and networks.

555: Practicum. 0-3-3 Maximum credit allowed is three semester hours. Prq., 12 semester hours of graduate work. Analytical and/or experimental solution of a problem in computer science; technical literature survey required; development of a computer-based solution.

557: Special Topics: Computer Science. 0-3-3 (G). The topic or topics will be selected by the instructor from the various sub-areas of computer science. May be repeated as topics change.

570: Advanced Topics in Computer Graphics. 0-3-3. Prq., CSC 470 or consent of instructor. Techniques used to produce realistic images of three-dimensional objects on computer graphics hardware. Topics include: reflection models, shading techniques, ray tracing, texture and object-based rendering.


582: Parallel Computational Methods. 0-3-3. Prq., CSC 240, MATH 415. Parallel implementations of FFT, interpolation, integration, Eigensystems, matrix maximization, ODEs, PDEs.


584: Computational Solutions for PDE II. 0-3-3. Prq., CSC 583 or MATH 574. Finite difference schemes for elliptic PDEs, iterative methods, and introduction to finite element methods and multigrid methods. Emphasis on program implementation.

COUNSELING (COUN)

400: Introduction to Counseling. 0-3-3. Introductory course for professional workers. Includes purposes and scope of counseling service, concepts, principles and basic techniques of counseling. (G)

401: Student Personnel Services. 0-3-3. A study of student personnel programs in colleges and universities. This course may not be taken for graduate credit.

460: Behavioral Counseling. 0-3-3. A non-cognitive approach to counseling that presents the necessary attitudes, concepts, principles, and skills for individual counseling.

500: Principles and Administration of Guidance Services. 0-3-3. An overview of the current principles and practices involved in various types of guidance and counseling services.

505: Analysis of the Individual. 3-2-3. Prq., PSYC 542 or equivalent. This course offers students an orientation to psychological testing procedures, their interpretation, evaluations and use in the understanding of clients.

506: Introduction to Rehabilitation Counseling. 0-3-3. Philosophical, social, psychological and legislative bases of rehabilitation; nature and scope of the process and functions of rehabilitation counselors.

507: Case Management in Rehabilitation Counseling. 0-3-3. Development of case management in procedures and skills: integration of theory and practice.

508: Introduction to Counseling Theories. 0-3-3. A detailed study of a selection of the best known schools of counseling theory.

510: Counseling the Elderly. 0-3-3. Dynamic and therapeutic models for counseling the aged and their families; focus on matching interventions to lifestyles.

512: Counseling the College Student. 0-3-3. An emphasis on development in young adulthood; historical, philosophical, and practical aspects of personnel services for college students.

513: Career Information and Career/Life Style Development. 0-3-3. A study of student personnel services for college students. This course offers students an orientation to psychological testing procedures, their interpretation, evaluations and use in the understanding of clients.

515: Career Education: Orientation of the World of Work. 0-3-3. A course in career guidance designed to provide an overview of career development and its applications within the high school setting.

517: Career Education: Vocational Guidance. 0-3-3. A course in career guidance designed to provide an overview of career development and its applications within the high school setting.
516: An Introduction to Group Processes. 0-3-3. Preq., COUN 508. Emphasis is on providing students with a knowledge of group dynamics, and learning basic group counseling techniques under supervision.  
520: Case Studies in Counseling. 1-3 hours credit. Preq., COUN 508 and consent of instructor. Preparation and use of case studies in counseling.  
521: Seminar: Current Psychological Literature. 1-3 hours credit. May be repeated. Preq., COUN 508 and consent of instructor. Students are required to do extensive reading on selected topics in psychology.  
522: Field Work in Counseling. 3 hours credit (6). Preq., COUN 518 and consent of instructor. Supervised study, observation, and practice in selected employment settings.  
523: Elementary School Guidance. 0-3-3. A review of the principles and organizational patterns of guidance services at the elementary school level.  
525: Advanced Techniques of Counseling. 3-2-3. Preq., COUN 518 and consent of instructor. Further experiences in advanced counseling techniques appropriate to various counseling theories.  
526: Problems in Guidance. 3 hours credit (6). Special conferences, workshops, and seminars as requested by elementary and secondary school personnel. May be repeated for a maximum of 6 hours credit.  
527: Addiction Counseling. 0-3-3. An introduction to the field of Addiction Counseling. Emphasis is placed on recognition and identification of the addicted as well as basic treatment techniques.  
528: Advanced Addiction Counseling. 3-2-3. Preq., COUN 527. A methods course intended to equip the student with a basic conception of various therapeutic modalities.  
529: Cross-cultural Counseling. 0-3-3. Investigation of the development of cultural identity and techniques for appropriate interactions with clients from different cultural groups.  
530: Practicum. 5-1-3. Open only by application. Supervised professional activity in the student's major field. (Minimum 3.0 GPA required)  
531: Internship. 20-1-3 (6). Preq., COUN 530 or equivalent and permission of adviser. Advanced supervised counseling practice in a setting appropriate to the student's professional development.  
532: School Counseling Practicum. 5-1-3. Open only by application. Supervised professional activity in a school setting. (Minimum 3.0 GPA is required)  
590: Ethics and Professional Practice. 0-3-3. Preq., COUN 508. An in-depth investigation of ethical and legal issues, as well as technical concerns, related to the professional practice of counseling.  

**ECONOMICS (ECON)**  
201: Economic Principles and Problems. 0-3-3 each. A study of basic economic principles and problems, with particular reference to the operation and social implications of the American economic system. (201-Macro).  
202: Economic Principles and Problems. 0-3-3 each. A study of basic economic principles and problems, with particular reference to the operation and social implications of the American economic system. (202-Micro).  
215: Fundamentals of Economics. 0-3-3. (Not open to students who have had ECON 201-202.) A survey of the major principles of economics designed for the student whose curriculum requires only one quarter of economic principles.  
312: Monetary Economics. 0-3-3. Preq., ECON 202 or 215. A study of the causes of changes in the supply of money and rate of spending and the effects of these changes on production, employment and the price level.  
344: International Economics. 0-3-3. Preq., ECON 201 or 215 or consent of instructor. Introduction to modes of business operations and the economic factors which affect international trade. Study of principles, practices, and theory of how and why nations trade.  
401: Internship in Economics I. 1-3 hours credit. (Pass/Fail) Preq. consent of instructor and senior standing. On site, supervised, structured work experiences in the field of business.  
402: Internship in Economics II. 3 hours credit. (Pass/Fail) Preq. consent of instructor and senior standing. On site, supervised, structured work experiences in the field of business.  
403: Economics of Industrial Organization. 0-3-3. Preq., ECON 202 or 215. Relationships between structure, conduct and performance of industries using theoretical and empirical material: Antitrust and environmental regulation, R&D, product advertising and pricing are examined. (G)  
406: Comparative Economic Systems. 0-3-3. Preq., ECON 202 or 215. A study of alternative economic systems such as capitalism, socialism, communism, and "mixed" in theory and practice.  
408: Intermediate Economic Theory. 0-3-3. Preq., ECON 202 or 215, or consent of instructor. An overview of microeconomic theory; intensive study of price, production, and distribution theories. (G)  
409: Managerial Economic Analysis. 0-3-3. Preq., senior standing or consent of instructor. Lectures and cases emphasizing economic principles as used in managerial decision-making. Includes analysis of demand, cost and price relationships, price decision, risk and uncertainty, and capital investment. (G)  
418: Labor Economics. 0-3-3. Preq., ECON 202 or 215 or consent of the instructor. Fundamentals of labor market operations, economic analysis of labor legislation; impact of American unions upon the firm's decision making and the national economy. (G)  
437: Aggregate Economic Analysis. 0-3-3. Preq., ECON 312. Macroeconomics: intensive study of economic theory of national income analysis, interest, employment, and fiscal policy. (G)  
510: Managerial Economics. 0-3-3. Analysis and cases; actual case studies in the application of price and distribution theory to problems of the firm.  
512: Current Economic Policies. 0-3-3. An investigation of modern economic concepts in the United States through a study of policies advanced by various economic groups tending to shape economic action.  
513: Macroeconomic Theory I. 0-3-3. Preq., ECON 437 or other acceptable background course(s). Analysis of monetary factors and government revenue-expenditure factors affecting the general level of prices, investment decisions, interest rates, national income and employment.  
520: Advanced Microeconomic Theory. 0-3-3. Preq., ECON 408 or other acceptable course(s). Value and distribution theory emphasizing applications to business operations and public policy issues.  
532: Econometric Methods. 0-3-3. Preq., QM 432 or other acceptable courses. The use of statistical techniques in economic research including estimation and interpretation of parameters of economic models.  
541: Microeconomics: Business Conditions Analysis. 0-3-3. Preq., ECON 510. Detailed review of techniques, procedures, and data sources used by business economists to gather, analyze, interpret and forecast microeconomic variables.  
542: Seminar on Business Economics Problems. 0-3-3. Preq., ECON 510 or equivalent or consent of instructor. Students will develop and present an analytical study in micro- or macroeconomics in a form expected of a business economist's presentation to corporate management.  
550: Directed Study in Economics. 0-3-3 each. Hours and credits to be arranged. Consent of instructor and approval of department head required. Special problem or specific area of economics.  
613: Macroeconomic Theory I. 0-3-3. Preq., ECON 437 or other acceptable background course(s). Requires Doctoral standing. May require additional class meetings. Analysis of monetary factors and government revenue-expenditure factors affecting the general level of prices, investment decisions, interest rates, national income and employment. Credit will not be given for ECON 613 if credit is given for ECON 513.  
620: Advanced Microeconomic Theory. 0-3-3. Preq., ECON 408 or other acceptable course(s). Requires Doctoral standing. May require additional class meetings. Value and distribution theory emphasizing applications to business operations and public policy issues. Credit will not be given for ECON 620 if credit is given for ECON 520.  
632: Econometric Methods. 0-3-3. Preq., QM 432 or other acceptable courses. Requires Doctoral standing. May require additional class meetings. The use of statistical techniques in economic research including estimation and interpretation of parameters of economic models. Credit will not be given for ECON 632 if credit is given for ECON 532.  
641: Microeconomics: Business Conditions Analysis. 0-3-3. Preq., ECON 510. Requires Doctoral standing. May require additional class meetings. Detailed review of techniques, procedures, and data sources used by business economists to gather, analyze, interpret and forecast microeconomic variables. Credit will not be given for ECON 641 if credit is given for ECON 541.