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### The College of Engineering 2010-2011 Undergraduate Course Descriptions

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## Architectural Engineering Courses

### AE 220 - Introduction to HVAC

This course includes a review of thermodynamics, moist air properties and processes, basic heat transfer, solar radiation, heating and cooling losses and load calculation, types of air conditioning systems, infiltration and ventilation, air motion and distribution.

Credits: 3.50

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CAEE 201 Minimum Grade: D and (ENGR 210 Minimum Grade: D or TDEC 202 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### AE 340 - Arch Illum & Elect Sys

This course covers building electrical systems, including power demand, distribution and control; building illumination techniques, including lighting demand, layout and energy analysis.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CAEE 201 Minimum Grade: D and (PHYS 102 Minimum Grade: D or TDEC 115 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### AE 380 - Special Topics in Architectural Engineering

Various topics of interest in the field of architectural engineering. See program director for details on topics

Credits: .50 to 12.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

### AE 390 - Architectural Engineering Design I

Establishes a base of building systems design concepts, knowledge and performance criteria, with emphasis on the thermal, electrical, illumination and structural aspects of buildings.

Credits: 4.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: AE 220 Minimum Grade: D and AE 340 Minimum Grade: D and ARCH 192 Minimum Grade: D and MEM 202 Minimum Grade: D

Repeat Status: Not repeatable for credit

### AE 391 - Architectural Engineering Design II

Emphasizes the development of insight into the solution of building system design problems, development of in-depth understanding of building systems design synthesis, and integration in a single building of modest scale and complexity.

Credits: 4.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: AE 390 Minimum Grade: D

Repeat Status: Not repeatable for credit

### AE 399 - Independent Study in Architectural Engineering

Independent study on a topic selected by the student. Independent study is supervised by a faculty member and guided by a plan of study.

Credits: 12.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Course can be repeated 98 time(s) for 998.00 credit(s)

### AE 430 - Control Systems for HVAC

This course introduces basic control concepts with applications to HVAC systems; direct digital control, control loops; system modeling; transfer functions; selecting and locating sensors and actuators; design and tuning control algorithms; design and programming of HVAC control systems.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: AE 220 Minimum Grade: D or MEM 413 Minimum Grade: D

Repeat Status: Not repeatable for credit

## Chemical Engineering Courses

**CHE 201 - Process Material Balances**

Covers elementary principles of chemical engineering, use of stoichiometry and material balances to analyze chemical processing operations, and application to specific commercial processes.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: TDEC 121 Minimum Grade: D or CHEM 102 Minimum

Grade: D or CHEM 162 Minimum Grade: D

Repeat Status: Not repeatable for credit

**CHE 202 - Process Energy Balances**

Covers use of first law to analyze chemical processing operations, energy balances for non-reactive and reactive processes, chemical reaction equilibria, and application to specific commercial processes.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Co-Requisites: CHE 206

Pre-Requisites: CHE 201 Minimum Grade: D

Repeat Status: Not repeatable for credit

**CHE 206 - Basic Chemical Engineering Thermodynamics**

First and second laws of thermodynamics, use of state functions to solve macroscopic problems, distinction between solving ideal gas and real fluid problems. An introduction to phase equilibrium and mixtures. Concepts of fugacity and activity as measures of nonideality.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following Major(s):

Chemical Engineering

Co-Requisites: CHE 202

Pre-Requisites: CHE 201 Minimum Grade: D and MATH 200 Minimum

Grade: D

Repeat Status: Not repeatable for credit

**CHE 250 - Chemical Engineering Process Principles**

Applies heuristics to the art process synthesis and analysis. Identify key parameters in reaction and separation in processes. Examine common and divergent elements of major chemical processes.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Co-Requisites: CHE 202

Pre-Requisites: CHE 201 Minimum Grade: D

Repeat Status: Not repeatable for credit

**CHE 301 - Process Thermodynamics**

Within the context of processes previously introduced, covers application of first and second laws to engineering processes, thermodynamic analysis of processes, and behavior of reacting and non-reacting homogeneous and heterogeneous mixtures.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: TDEC 202 Minimum Grade: D or MEM 210 Minimum

Grade: D or CHE 206 Minimum Grade: D

Repeat Status: Not repeatable for credit

**CHE 302 - Process Fluid Mechanics**

Within the context of processes previously introduced, introduces fluid flow of gases, liquids, and particulates; momentum transport; skin friction; drag; piping networks; filtration; and fluidization.

Credits: 4.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: TDEC 221 Minimum Grade: D or MATH 210 Minimum

Grade: D or MATH 262 Minimum Grade: D or ENGR 232 Minimum

Grade: D

Repeat Status: Not repeatable for credit

**CHE 303 - Process Heat Transfer**

Covers, within the context of processes previously introduced, transfer of energy by conduction, convection, and radiation; continuation of transport phenomena; design of heat exchangers; and applications in industry and in nature.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CHE 302 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CHE 304 - Process Mass Transfer**

Covers, within the context of processes previously introduced, mass transfer in mixtures; diffusion, convection, and continuation of transport phenomena; component separation in continuous reactors; gas absorption; liquid-liquid extraction; and simultaneous heat and mass transfer.

Credits: 4.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CHE 303 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CHE 305 - Process Separations**

Covers, within the context of processes previously introduced, the application of thermodynamics and equilibrium stage concepts to the unit operations involved in chemical processing.

Credits: 4.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CHE 301 Minimum Grade: D and CHE 307 Minimum Grade: D

Grade: D

Repeat Status: Not repeatable for credit

#### **CHE 307 - Process Modeling I**

Models simple chemical and biochemical processes such as heating, cooling, and separation systems. Covers analytical and numerical methods for solving algebraic and ordinary differential equations.

Credits: 4.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: TDEC 221 Minimum Grade: D or MATH 210 Minimum Grade: D or MATH 262 Minimum Grade: D or ENGR 232 Minimum Grade: D

Grade: D

Grade: D

Repeat Status: Not repeatable for credit

#### **CHE 308 - Process Modeling II**

Covers mathematical modeling of chemical and biochemical processes such as chemical and biochemical reactors and heating and cooling systems, analytical methods for solving algebraic and ordinary differential equations.

Credits: 4.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Co-Requisites: CHE 304

Pre-Requisites: CHE 305 Minimum Grade: D and CHE 307 Minimum Grade: D

Grade: D

Repeat Status: Not repeatable for credit

#### **CHE 310 - Transport Phenomena**

Non-chemical engineering students only. Examines mass, momentum, and energy transport in processes applied to electrical and materials engineering.

Credits: 4.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following Major(s):

Chemical Engineering

May not have the following Classification(s):

Freshman

Pre-Requisites: TDEC 202 Minimum Grade: D or MEM 210 Minimum Grade: D or ENGR 210 Minimum Grade: D

Grade: D or ENGR 210 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CHE 311 - Fluid Flow and Transport**

Non-chemical engineering students only. Examines fluid flow and heat and mass transfer in processes associated with civil, environmental, and materials engineering disciplines.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following Major(s):

Chemical Engineering

May not have the following Classification(s):

Freshman

Pre-Requisites: TDEC 202 Minimum Grade: D or MEM 210 Minimum Grade: D

Grade: D

Repeat Status: Not repeatable for credit

#### **CHE 332 - Chemical Engineering Laboratory**

Requires students to perform experiments illustrating the fundamentals of chemical engineering process analysis. This is a writing intensive course.

Credits: 2.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Co-Requisites: CHE 302

Pre-Requisites: CHE 301 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CHE 333 - Chemical Engineering Laboratory II**

Offers laboratory experiments illustrating the fundamentals of chemical engineering process analysis. This is a writing intensive course.

Credits: 2.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Co-Requisites: CHE 305

Pre-Requisites: CHE 302 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CHE 334 - Chemical Engineering Lab III**

Offers laboratory experiments illustrating the fundamentals of chemical engineering process analysis. This is a writing intensive course.

Credits: 2.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Co-Requisites: CHE 304

Pre-Requisites: CHE 305 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CHE 335 - Statistics and Design of Experiments**

Provides statistical treatment of engineering data, including application of statistical techniques to process model formulation, statistical designs of engineering experiments, and analysis of probabilistic systems.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MATH 210 Minimum Grade: D or MATH 262 Minimum Grade: D or TDEC 221 Minimum Grade: D or ENGR 232 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CHE 360 - BioProcess Principles**

This course is concerned with manufacturing processes involving biological substances. Students gain detailed knowledge in the design and operation of bioreactors and learn about biomolecules produced therein. Specific topics covered include: Cells (type, organization, function and growth); Protein and Enzymes; Bioreactor Process Principles (active vs. passive immobilization, fermentation and scale-up, recovery and purification); Special consideration for animal and plant cell cultures.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: CHE 250 Minimum Grade: D and BIO 214 Minimum Grade: D and BIO 215 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CHE 399 - Special Probs Chem Engr**

Covers individual research problems of a non-routine nature. Requires report.

Credits: 1.00 to 12.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

### **CHE 400 - Special Tops Chem Engr**

Special courses offered in response to particular student and/or faculty interest.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

### **CHE 420 - Process Systems Engineering**

Covers the application of automatic control theory to chemical processes within the context of processes previously introduced.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: TDEC 221 Minimum Grade: D or MATH 210 Minimum

Grade: D or MATH 262 Minimum Grade: D or ENGR 232 Minimum

Grade: D

Repeat Status: Not repeatable for credit

#### **CHE 424 - Chemical Kinetics and Reactor Design**

Covers isothermal and non-isothermal reactor design, series and parallel reactions, and heterogeneous catalysis.

Credits: 4.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CHE 304 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CHE 450 - Chemical Process Industries**

Chemical engineering juniors and seniors. Combines process heuristics and design strategies with case studies of the industrial manufacture of a variety of materials, including petrochemicals, polymers, and ammonia. Discusses operational and design problems as well as the interactions of process principles.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following Major(s):

May not have the following Classification(s):

Freshman

Pre-Junior

Sophomore

Pre-Requisites:

Repeat Status: Not repeatable for credit

#### **CHE 451 - Safety Engineering**

Covers selected topics such as safeguarding systems, fault trees, risk analysis, explosions, fires, and building safety.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

Must have the following Classification(s):

Senior

Pre-Requisites: CHE 482 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CHE 452 - Polymer Process Technology**

Covers chemistry of chain and stepwise polymerization, industrial reactor systems, polymer melt rheology, processing of thermoplastic resins, and plastics properties.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following College(s)/School(s):

Arts and Sciences

College of Engineering

Must have the following Classification(s):

Junior

Senior

Repeat Status: Not repeatable for credit

#### **CHE 460 - Biochemical Engineering**

Introduces underlying biological and engineering principles in an integrate fashion for biopharmaceutical production systems.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following Major(s):

Biomedical Engineering

Chemical Engineering

Must have the following Classification(s):

Junior

Senior

Repeat Status: Not repeatable for credit

#### **CHE 481 - Process Design I**

Within the context of previously introduced processes, covers economic feasibility of projects and optimization of equipment and production in the design of process plants.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following Major(s):

Chemical Engineering

Must have the following Classification(s):

Senior

Co-Requisites: CHE 424

Pre-Requisites: CHE 304 Minimum Grade: D and CHE 308 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CHE 482 - Process Design II**

Within the context of previously introduced processes, covers execution of feasibility study and preliminary design of process plants.

This is a writing intensive course.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: CHE 481 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CHE 483 - Process Design III**

Within the context of previously introduced processes, covers completion of feasibility study and preliminary design of process plants.

This is a writing intensive course.

Credits: 3.00

College: College of Engineering

Department: Chemical Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: CHE 482 Minimum Grade: D

Repeat Status: Not repeatable for credit

## **Civil & Architectural Engineering Courses**

### **CAE 491 - Senior Design Project I**

Introduces the design process, including information retrieval, problem definition, proposal writing, patents, and design notebooks. Includes presentations on problem areas by experts from industry, government, and education. This is a writing intensive course.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: CIVE 330 Minimum Grade: D and (CIVE 301 Minimum Grade: D or CIVE 371 Minimum Grade: D ) and (AE 391 Minimum Grade: D or CIVE 310 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### **CAE 492 - Senior Design Project II**

Continues CAE 491. Requires written and oral progress reports. This is a writing intensive course.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CAE 491 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CAE 493 - Senior Design Project III**

Continues CAE 492. Requires written and oral final reports, including oral presentations by each design team at a formal Design Conference open to the public and conducted in the style of a professional conference. This is a writing intensive course.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CAE 492 Minimum Grade: D

Repeat Status: Not repeatable for credit

## **Civil Engineering Courses**

### **CIVE 240 - Engineering Economic Analysis**

Techniques for project decisions: benefit cost and present worth analysis, rate of return, capital budgeting, risk analysis, environmental impact, and depreciation. This is a writing intensive course.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites:

Repeat Status: Not repeatable for credit

### **CIVE 250 - Construction Materials**

Construction Materials

Credits: 4.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: MEM 202 Minimum Grade: D

Repeat Status:

### **CIVE 251 - Engineering Surveying**

Covers the theory and use of surveying instruments and principles of plane and topographic surveying. Introduces computer programs for surveying computations and plotting.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Not repeatable for credit

### **CIVE 261 - Materials and Structural Behavior I**

Introduces the basic materials of construction (timber, masonry, steel, and concrete). Covers their behavior as ingredients of the structural system. Required for architecture and construction management students. Fall.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following Major(s):

Architectural Engineering

Civil Engineering

May not have the following Classification(s):

Freshman

Pre-Requisites: PHYS 182 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 262 - Materials and Structural Behavior II**

Continues CIVE 261. Required for architecture and construction management students. Winter.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following Major(s):

Architectural Engineering

Civil Engineering

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 261 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 263 - Materials and Structural Behavior III**

Continues CIVE 262. Required for architecture and construction management students. Spring.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following Major(s):

Architectural Engineering

Civil Engineering

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 262 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 300 - Theory of Structures I**

Covers analysis of statically determinate structures: equilibrium, compatibility, boundary conditions, complimentary and virtual work, energy theorems, reactions, member forces and deflection of trusses, beams and frames, and influence lines.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 250 Minimum Grade: D and MEM 230 Minimum Grade: C

Repeat Status: Not repeatable for credit

### **CIVE 301 - Theory of Structures II**

Covers analysis of statically indeterminate structures: force methods for trusses, beams and frames, slope-deflection and equilibrium methods, moment distribution, stiffness matrices of truss and beam elements, and stiffness matrix method of analysis.

Credits: 4.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 300 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 310 - Soil Mechanics I**

Gives an overview of types of problems encountered in geotechnical engineering: index, mechanical, hydraulic and environmental properties of soils; earth mass stability, deformation, and groundwater seepage; laboratory measurements.

Credits: 4.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:



May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: (EGEO 220 Minimum Grade: D or CAEE 211 Minimum Grade: D ) and CIVE 250 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 320 - Introduction to Fluid Flow**

Covers fundamentals of fluid flow, fluid properties, hydrostatic forces, kinematics of flow, the Bernoulli equation, linear momentum, dimensional analysis, Froude and Reynolds similarity and hydraulic models and an introduction to pipe flows and friction

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

May not have the following Classification(s):

Pre-Requisites: TDEC 202 Minimum Grade: D or ENGR 210 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 330 - Hydraulics**

Covers pipe flow, friction losses, multiple pipe systems, water demand and distribution network design, pumps and pumping systems, air flow in ducts and fans, open channel flows, hydraulic jumps and energy dissipation, gravity pipe networks and the design of storm and sanitary sewer systems.

Credits: 4.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

Pre-Requisites: CIVE 320 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 341 - Municipal Water Facilities**

Covers analysis and design of municipal water supply systems, including collection, transmission and distribution facilities; public health considerations in water supply; and maintenance of water supply infrastructure.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 330 Minimum Grade: D and CIVE 430 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 370 - Introduction to Structural Analysis**

Covers equilibrium, virtual work, reactions, and member forces in trusses, beams, and frames. Introduces analysis of statically indeterminate structures and the stiffness matrix method of analysis.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 230 Minimum Grade: D and CIVE 250 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 371 - Introduction to Structural Design**

Covers the design process, with topics including structural systems, loads and load path, structural safety, and design methods. Offers introduction to steel, reinforced concrete, wood, and masonry design.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 370 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 372 - Structural Laboratory**

Course use of structural analysis computer programs to construct analytical models of various structural systems. Calculate reactions and deflections of statically determinate and determinate structures and check reliability of results.

Credits: 1.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Sophomore

Co-Requisites: CIVE 371

Pre-Requisites:

Repeat Status: Not repeatable for credit

### **CIVE 375 - Structural Material Behavior**

Study of deformation, fracture and fatigue of structural materials used in infrastructure. Includes basic failure modes, yielding and plasticity, and fracture mechanics. Emphasis on analytical and predictive methods that designers use to avoid failure. Metals, ceramic and composites are considered, as is time-dependent behavior.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 230 Minimum Grade: D and CIVE 250 Minimum

Grade: D and MATH 201 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 380 - Special Topics Civil Engr**

Covers selected topics in civil engineering.

Credits: 12.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

### **CIVE 399 - Independent Study in Civil Eng**

Independent study on a topic selected by the student. Independent study is supervised by a faculty member and guided by a plan of study.

Credits: 12.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Course can be repeated 98 time(s) for 998.00 credit(s)

### **CIVE 400 - Structural Design I**

Covers principles of design of structural members and systems, including loads on structures, structural safety, and structural members and their behavior. Introduces elastic and limit design procedures.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: CIVE 301 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 401 - Structural Design II**

Covers principles of design of reinforced concrete structural systems, including beams, slabs, columns, and footings.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 400 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 402 - Structural Design III**

Covers elastic and plastic design of structural steel members, including beams, columns, tension members, beam columns, and plate girders; design of welded and high-strength bolted connections; and design of steel trusses, bridges, and buildings.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 401 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 410 - Foundation Engineering**

Covers shear strength, bearing capacity, and lateral earth pressure; design of shallow foundations (footings, mats) and deep foundations (piles, drilled shafts); and excavation and slope stability.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: CIVE 310 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CIVE 420 - Water and Waste Treatment I**

Covers water supply chemistry, including corrosion in water distribution systems, microbiology of water and wastes, biodegradation of toxic materials, and growth and metabolism in wastewater treatment processes.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: CIVE 330 Minimum Grade: D and CIVE 340 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CIVE 430 - Hydrology**

Covers the relationship between precipitation and runoff, unit hydrographs, flood routing, and water supply principles and applications.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CAEE 211 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CIVE 431 - Hydrology-Ground Water**

Covers geologic and hydrologic occurrence of groundwater, underground flow, and groundwater supply. Winter.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 330 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CIVE 432 - Water Resources Design**

Covers planning and design of basin and developments for requirements of various water use purposes. Spring.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 430 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CIVE 477 - Seminar**

Covers professional development and ethics. Requires preparation of a technical paper. This is a writing intensive course.

Credits: 2.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Junior

Senior

Pre-Requisites:

Repeat Status: Not repeatable for credit

#### **CIVE 478 - Seminar**

Requires preparation and presentation of a technical paper. This is a writing intensive course.

Credits: 1.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Junior

Senior

Repeat Status: Not repeatable for credit

### **Civil, Architectural & Environmental Engineering Courses**

#### **CAEE 201 - Introduction to Infrastructure Engineering**

This course presents case studies to introduce the design, construction, operation and maintenance of infrastructure projects. Key engineering elements within civil, architectural and environmental engineering are presented. The concept of an "infrastructure system" along with interrelationships among three disciplines are illustrated using specific case studies which changes annually as various local infrastructure projects move from design through construction. On or two field trips are part of the course.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):

Arts and Sciences

College of Engineering

May not have the following Classification(s):

Repeat Status: Not repeatable for credit

#### **CAEE 210 - Measurements in Civil, Architectural and Environmental Engineering I**

This course introduces student to various technical specialties within Civil, Architectural and Environmental engineering through hands-on experience of conducting field and laboratory measurements that are typical to three engineering fields. The course emphasizes graphical presentation of data using EXCEL, SKETCHUP and other software. Students collect data from lab or field sites.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):

Arts and Sciences

College of Engineering

Pre-Requisites: CAEE 201 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CAEE 211 - Measurements in Civil, Architectural and Environmental Engineering II**

This course is a continuation of CAEE 210. There are two main modules in the course: fundamental geological principles and relationships to engineering properties and fundamental surveying principles and measurements using modern surveying equipment including GPS.

Credits: 4.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):

Arts and Sciences

College of Engineering

Pre-Requisites: CAEE 210 Minimum Grade: D

Repeat Status: Not repeatable for credit

## **Computer Science Courses**

### **CS 121 - Computation Lab I**

Introduces computation and programming through the use of a symbolic mathematical computation system. Programming techniques and algorithmic problem solving are introduced in the context of the differential calculus. Illustrates the power and limitations of the computer in solving mathematical, engineering and scientific problems. Some or all pre-requisites may be taken as either a pre-requisite or co-requisite. Please see the department for more information.

Credits: 1.00

College: College of Engineering

Department: Computer Science

Pre-Requisites: MATH 110 Minimum Grade: D (May be taken concurrently) or MATH 121 Minimum Grade: D (May be taken concurrently) or MATH 122 Minimum Grade: D (May be taken concurrently) or MATH 123 Minimum Grade: D (May be taken concurrently) or MATH 200 Minimum Grade: D (May be taken concurrently)

Repeat Status: Not repeatable for credit

### **CS 122 - Computation Lab II**

Introduces computation and programming through the use of a symbolic mathematical computation system. Programming techniques and algorithmic problem solving are introduced in the context of the integral calculus. Illustrates the power and limitations of the computer in solving mathematical, engineering and scientific problems. Some or

all pre-requisites may be taken as either a pre-requisite or co-requisite. Please see the department for more information.

Credits: 1.00

College: College of Engineering

Department: Computer Science

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: CS 121 Minimum Grade: D and (MATH 121 Minimum Grade: D (May be taken concurrently) or MATH 122 Minimum Grade: D (May be taken concurrently) or MATH 123 Minimum Grade: D (May be taken concurrently) or MATH 200 Minimum Grade: D (May be taken concurrently))

Repeat Status: Not repeatable for credit

### **CS 123 - Computation Lab III**

Introduces computation and programming through the use of a symbolic mathematical computation system. Programming techniques and algorithmic problem solving are introduced in the context of the multivariate calculus and series. Illustrates the power and limitations of the computer in solving mathematical, engineering and scientific problems. Some or all pre-requisites may be taken as either a pre-requisite or co-requisite. Please see the department for more information.

Credits: 1.00

College: College of Engineering

Department: Computer Science

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: CS 122 Minimum Grade: D and (MATH 122 Minimum Grade: D (May be taken concurrently) or MATH 123 Minimum Grade: D (May be taken concurrently) or MATH 200 Minimum Grade: D (May be taken concurrently))

Repeat Status: Not repeatable for credit

### **CS 130 - Programming Concepts with 3D Animation**

Introduction to elementary programming concepts within a 3D animation learning environment. Programming concepts include: planning tools (storyboards, pseudocode), control structures, expressions, conditionals, repetition, functions, parameter passing, events and event handlers, classes, objects, methods, inheritance. Stresses good programming style, documentation, debugging, and testing.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Not repeatable for credit

### **CS 131 - Computer Programming A**

Introduction to structured computer programming in the language of instruction (e.g. C++). Topics include: variables, input and output, expressions, assignment statements, conditionals and branching, files,

repetition, functions and parameter passing. Stresses good programming style, documentation, debugging, and testing.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Co-Requisites: EXAM 080

Repeat Status: Not repeatable for credit

### **CS 132 - Computer Programming B**

Introduction to structured computer programming in the language of instruction (e.g. C++). Topics include: random numbers, recursion, vectors, searching and sorting, classes, information hiding principles. Stresses good programming style, documentation, debugging, and testing.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Co-Requisites: EXAM 080

Pre-Requisites: CS 131 Minimum Grade: D or CS 171 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 133 - Computer Programming C**

Advanced principles of computer programming in the language of instruction (e.g. C++: Classes, inheritance, information hiding principles, recursion, quicksort, multidimensional arrays, pointers, and dynamic memory. Stresses good programming style, documentation, debugging, and testing.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Co-Requisites: EXAM 080

Pre-Requisites: CS 132 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 161 - Introduction to Computing**

Introduction to the computer as a tool for productivity and communications. Provides fluency in the use of industry-standard software for professional communications and presentations, data analysis, and telecommunication. Introduce automation and programming to enhance the effective use of computers and computer applications.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following College(s)/School(s):

College of Engineering

Co-Requisites: EXAM 080

Repeat Status: Not repeatable for credit

### **CS 164 - Introduction to Computer Science**

An introduction to the field of computer science. Exposure to core areas (selected from algorithms, artificial intelligence, computer architecture, databases, graphics, human-computer interaction, programming languages, scientific computation, software engineering) while introducing and reinforcing the importance of programming.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following Major(s):

Computer Science

Mathematics

Must have the following Classification(s):

Freshman

Co-Requisites: EXAM 080

Repeat Status: Not repeatable for credit

### **CS 171 - Computer Programming I**

Covers fundamentals of structured computer programming in the language of instruction (e.g., C++): variables, input and output, expressions, assignment statements, conditionals and branching, subprograms, parameter passing, repetition, arrays, top-down design, testing, and debugging.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Co-Requisites: EXAM 080

Repeat Status: Not repeatable for credit

### **CS 172 - Computer Programming II**

Covers object-oriented design, inheritance hierarchies, information hiding principles, string processing, recursion, good programming style, documentation, debugging, and testing.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Co-Requisites: EXAM 080

Pre-Requisites: CS 171 Minimum Grade: D or CS 132 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 190 - Selected Computer Language**

Focuses on programming in a selected language of interest. Course content, language, and prerequisites may vary according to instructor, with emphasis on applications for which the language is designed. May be repeated for credit.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Repeat Status: Course can be repeated 98 time(s) for 998.00 credit(s)

### **CS 203 - Programming for Engineers**

Fundamentals of computer organization; rudiments of programming including data types, arithmetic and logical expressions, conditional statements, control structures; problem solving techniques for engineers using programming; object-oriented programming; arrays; simulation of engineering systems; principles of good programming practice.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

May not have the following Classification(s):

Freshman

Repeat Status: Not repeatable for credit

### **CS 204 - Advanced Programming for Engineers**

An advanced introduction to classes and objects; inheritance and polymorphism; abstract classes and interfaces; exception handling; files and streams; garbage collection and dynamic memory allocation; recursion; using linked lists, stacks, queues, and trees; search and sorting algorithms; generic methods and classes; a comparative introduction to dominant programming languages; engineering examples.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

Must be enrolled in one of the following Program Level(s):

Graduate Quarter

Undergraduate Quarter

Pre-Requisites: ECE 203 Minimum Grade: D or CS 203 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 260 - Data Structures**

Covers stacks, queues, linked allocation, binary trees, internal searching and sorting, hashing, and applications.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 265 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 265 - Advanced Programming Tools and Techniques**

Introduction to the basic principles of programming practice: testing, debugging, portability, performance, design alternatives, and style. Application in a variety of programming languages programming environments, and operating systems. Introduction to tools used in the software development process for improving program functionality, performance, and robustness.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 172 Minimum Grade: D or CS 133 Minimum Grade: D

or SE 103 Minimum Grade: D or ECEC 301 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 270 - Mathematical Foundations of Computer Science**

Emphasizes analytic problem-solving and introduction of mathematical material necessary for later courses in algorithms, compiler theory, and artificial intelligence. Includes topics such as logic, theorem-proving, language operations, context-free grammars and languages, recurrence relations, and analysis of algorithms.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 172 Minimum Grade: D or CS 265 Minimum Grade: D

or SE 103 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 280 - Special Topics in Comp Sci**

Covers topics in modern computer science. Different topics may be considered in different quarters.

Credits: 12.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

### **CS 281 - Systems Architecture I**

Covers internal function and organization of digital computers, including instruction sets, addressing methods, input-output architectures, central processor organization, machine language, and assembly language.

Credits: 4.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: (ECE 200 Minimum Grade: D or CS 270 Minimum Grade: D ) and (CS 172 Minimum Grade: D or SE 103 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### **CS 282 - Systems Architecture II**

Covers computer system operations, assembly language programming techniques, operating system interfacing, and organization of assemblers and loaders.

Credits: 4.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 281 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 283 - Systems Programming**

This course introduces computer systems, including interaction of hardware and software through the operating system, from the programmer's perspective. Three fundamental abstractions are emphasized; processes, virtual memory, and files. These abstractions provide programmers a common interface to a wide variety of hardware devices. Topics covered include linking, system level I/O, concurrent programming, and network programming.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 265 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 300 - Applied Symbolic Computation**

This course covers the fundamentals of symbolic mathematical methods as embodied in symbolic mathematics software systems, including: fundamental techniques, simplification of expressions, solution of applications problems, intermediate expressions swell, basic economics of symbolic manipulation, efficient solution methods for large problems, hybrid symbolic/numeric techniques.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 260 Minimum Grade: D and CS 270 Minimum Grade:

D and MATH 200 Minimum Grade: D and MATH 201 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 303 - Algorithmic Number Theory & Cryptography**

Covers fundamental algorithms for integer arithmetic, greatest common divisor calculation, modular arithmetic, and other number theoretic computations. Algorithms are derived, implemented and analyzed for primality testing and integer factorization. Applications to cryptography are explored including symmetric and public-key cryptosystems. A cryptosystem will be implemented and methods of attack investigated.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 260 Minimum Grade: D and MATH 221 Minimum

Grade: D and (MATH 201 Minimum Grade: D or MATH 261 Minimum

Grade: D or ENGR 231 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### **CS 337 - Human-Computer Interaction**

Applies cognitive and experimental psychology to the understanding of human-computer interaction.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: PSY 101 Minimum Grade: D and CS 171 Minimum

Grade: D

Repeat Status: Not repeatable for credit

### **CS 338 - Graphical User Interfaces**

This course covers the design and implementation of graphical user interfaces. Topics include: event-driven programming, application programmer interfaces, widgets, callback functions, windowing systems and desktops, rapid prototyping languages, multithreaded GUI's. A

term project involving implementation of a complex application will be undertaken.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 350 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 345 - Computer Game Design and Development**

This course introduces students to the computer game design process. Students also learn how the individual skills of modeling, animation, scripting, interface design and story telling are coordinated to produce interactive media experiences for various markets, devices and purposes.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: DIGM 260 Minimum Grade: D and (CS 265 Minimum Grade: D or DIGM 141 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### **CS 350 - Software Design**

Covers software design methods and implementation. Good design and implementation approached will be motivated through software examples and reinforced through programming projects. Topics include architectural styles, code reuse, modularity and information hiding principles, object-oriented design patterns, design specification and formal methods, good coding and documentation practices. This is a writing intensive course.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Sophomore

Pre-Requisites: CS 260 Minimum Grade: D and CS 265 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 360 - Programming Language Concepts**

Introduces the design and implementation of modern programming languages: formal theory underlying language implementation; concerns in naming, binding, storage allocation and typing; semantics of expressions and operators, control flow, and subprograms; procedural and data abstraction; functional, logic, and object-oriented languages. Students will construct an interpreter for a nontrivial language.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 260 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 361 - Concurrent Programming**

Covers programming of concurrent, cooperating sequential processes. Studies race conditions, critical sections, mutual exclusion, process synchronization, semaphores, monitors, message passing, the rendezvous, deadlock, and starvation.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 260 Minimum Grade: D and CS 281 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 365 - System Administration**

Fundamentals of system administration featuring hands-on practice with an industry standard operating system. Focus on installation, maintenance and management of several systems for multi-user environments.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 260 Minimum Grade: D and CS 265 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 370 - Operating Systems**

Explores the internal algorithms and structures of operating systems: CPU scheduling, memory management, files systems, and device management. Considers the operating system as a collection of cooperating sequential processes (servers) providing an extended or virtual machine that is easier to program than the underlying hardware. Topics include virtual memory, input/output devices, disk request scheduling, deadlocks, file allocation, and security and protection.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):



Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 282 Minimum Grade: D and CS 361 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 380 - Artificial Intelligence**

Explores the foundations of artificial intelligence: production systems, heuristic programming, knowledge representation, and search algorithms. Also covers programming in an AI language. Additional topics chosen from game theory, decision support systems, pattern matching and recognition, image understanding, natural language, fuzzy and non-monotonic logic, machine learning, theorem proving, and common sense reasoning.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 260 Minimum Grade: D and CS 270 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 430 - Computer Graphics**

The course presents the fundamental geometric representations and drawing algorithms of computer graphics through lectures and programming assignments. The representations include lines, curves, splines, polygons, meshes, parametric surfaces and solids. The algorithms include line drawing, curve and surface evaluation, polygon filling, clipping, 3D-to-2D projection and hidden surface removal.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Pre-Requisites: MATH 200 Minimum Grade: D and MATH 201 Minimum Grade: D and CS 350 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 431 - Advanced Rendering Techniques**

The creation of realistic images from 3D models is central to the development of computer graphics. The ray tracing algorithm has become one of the most popular and powerful techniques from creating photo-realistic images. This class explores the algorithmic components of ray tracing. Students implement many of these components in their class programming projects.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: CS 430 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 432 - Interactive Computer Graphics**

This is a project-oriented class that covers the concepts and programming details of interactive computer graphics. These include graphics primitives, display lists, picking, shading, rendering buffers and transformations. Students will learn and industry-standard graphics system by implementing weekly programming assignments. The course culminates with a student-defined project.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 430 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 435 - Computational Photography**

Fundamentals of computational photography, an interdisciplinary field at the intersection of computer vision, graphics, and photography. Covered topics include fundamentals of cameras, novel camera designs, image manipulation, single-view modeling, and image-based rendering with an emphasis on learning the computational methods and their underlying mathematical concepts through hands-on assignments.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: (MATH 123 Minimum Grade: D or MATH 200 Minimum Grade: D ) and (MATH 201 Minimum Grade: D or MATH 261 Minimum Grade: D or ENGR 231 Minimum Grade: D ) and CS 260 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 440 - Theory of Computation**

Finite automata, regular sets, and regular expressions; pushdown automata, context-free languages, and normal forms for grammars; Turing machines and recursively enumerable sets; Chomsky hierarchy; computability theory.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Sophomore

Pre-Requisites: CS 270 Minimum Grade: D and MATH 221 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **CS 441 - Compiler Workshop I**

Design and implementation of compiler for specified language. Practical application and in-depth study of parsing, scanning, run-time storage management, type analysis, code generation, and error recovery.

Credits: 3.00

College: College of Engineering  
Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Sophomore

Pre-Requisites: CS 270 Minimum Grade: D and CS 282 Minimum Grade: D and CS 360 Minimum Grade: D and CS 440 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CS 442 - Compiler Workshop II**

Continuation of CS 441. Advanced topics in compilation, code generation, and optimization for various programming languages and paradigms.

Credits: 3.00

College: College of Engineering  
Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Sophomore

Pre-Requisites: CS 441 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CS 445 - Topics in Computer Gaming**

Contemporary topics in the design and implementation of computer games. Topics may include game genres, psychological and sociological aspects of games, software tools and game development engines, character and behavior modeling, physical models and realism, virtual reality, graphics and animation, network-based, performance analysis and efficiency.

Credits: 3.00

College: College of Engineering  
Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 345 Minimum Grade: D or DGM 345 Minimum Grade: D

Repeat Status: Course can be repeated 3 time(s) for 9.00 credit(s)

#### **CS 451 - Software Engineering**

Covers requirements specification, system modeling, formal methods, architectural design, object-oriented design, programming for reliability, user interface design, functional and structural testing, software reuse, and configuration management.

Credits: 3.00

College: College of Engineering  
Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 270 Minimum Grade: D and MATH 221 Minimum Grade: D and CS 350 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CS 457 - Data Structures & Algorithms I**

This course covers techniques for analyzing algorithms, including: elementary combinatorics, recurrence relations, and asymptotic analysis; data structures such as hash tables, red-black trees, B-trees, binomial and Fibonacci heaps, union-find trees; sorting algorithms and elementary graph algorithms.

Credits: 3.00

College: College of Engineering  
Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 260 Minimum Grade: D and CS 270 Minimum Grade: D and MATH 221 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CS 458 - Data Structures & Algorithms II**

This course presents algorithm design techniques such as dynamic programming, greedy methods, divide and conquer, amortized algorithms; more graph algorithms for minimum spanning trees, shortest paths, and network flows; string matching algorithms; algorithms for finding convex hull of a discrete set of points; NP-Completeness and approximation algorithms.

Credits: 3.00

College: College of Engineering  
Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 457 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **CS 461 - Database Systems**

Covers topics including structure and function of database systems, normal form theory, data models (relational, network, and hierarchical), query processing (ISBL), relational algebra and calculus, and file structures. Includes programming project using DBMS.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 260 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 470 - Operating Systems Workshop**

Studies a modern multitasking operating system in detail, including device drivers, CPU scheduling, memory management, and file systems. Includes programming assignments that modify or enhance the operating system.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 282 Minimum Grade: D and CS 370 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 472 - Computer Networks**

Introduction to computer networking theory, applications and programming, focusing on large heterogeneous networks. Broad topdown introductions to computer networking concepts including distributed applications, socket programming, operation system and router support, router algorithms, and sending bits over congested, noisy and unreliable communication links.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Pre-Requisites: CS 361 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 475 - Computer and Network Security**

The key objective of this work is to provide a thorough understanding of technologies and methodologies with which computer networks can be protected. Topics that are covered include: Key Management Credentials, Steganography and Watermarking, Networking Security (VPNs, Firewalls, Intrusion Detection) and System Security Policies.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: CS 472 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **CS 476 - High Performance Computing**

This course is an introduction to high performance computing, including concepts and applications. Course contents will include discussions of different types of high performance computer architectures (multi-core/multi-threaded processors, parallel computers, etc), the design, implementation, optimization and analysis of efficient algorithms for uni-processors, multi-threaded processors, and parallel computers, and high performance programming.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: (CS 281 Minimum Grade: D and CS 283 Minimum Grade: D ) or (ECEC 353 Minimum Grade: D and ECEC 355 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### **CS 480 - Special Topics in Comp Science**

Covers topics in computer science of interest to students or faculty. Different topics may be considered during different quarters.

Credits: 12.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Course can be repeated 98 time(s)

### **CS 481 - Adv Artificial Intelligence**

This course covers topics in representation, reasoning, and decision-making under uncertainty; learning; solving problems with time-varying properties. Assignments applying AI techniques toward building intelligent machines that interact with dynamic, uncertain worlds will be given.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 380 Minimum Grade: D and (MATH 311 Minimum Grade: D or MATH 410 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### **CS 485 - Special Topics in AI**

A variety of special topics are offered in artificial intelligence (AI) including: intelligent time-critical reasoning, knowledge-based agents, machine learning, natural language processing, and geometric reasoning. This course may be repeated for credit as topics vary.

Credits: 3.00  
College: College of Engineering  
Department: Computer Science  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Pre-Requisites: CS 260 Minimum Grade: D and CS 380 Minimum Grade:  
D  
Repeat Status: Course can be repeated 98 time(s) for 998.00 credit(s)

#### **CS 491 - Software Engineering Workshop**

Offers in-depth study and application of software engineering practice. Students work in teams to develop a significant software system. Course is intended to serve as a capstone experience for students in the senior year. The project involves the specification and review of software requirements and designs, implementation and code inspections, functional testing, and documentation.  
Credits: 3.00  
College: College of Engineering  
Department: Computer Science  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Pre-Requisites: CS 451 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **CS 492 - Software Engineering Workshop II**

Continues CS 491 team project.  
Credits: 3.00  
College: College of Engineering  
Department: Computer Science  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Pre-Requisites: CS 491 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **CS 493 - Software Engineering Workshop III**

Continues CS 492 team project.  
Credits: 3.00  
College: College of Engineering  
Department: Computer Science  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Pre-Requisites: CS 492 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **CS 498 - Indep Study in Comp Science**

Provides supervised study of selected topics in computer science.  
Credits: 12.00  
College: College of Engineering  
Department: Computer Science  
Restrictions:

May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

### **Electrical & Computer Engineering: Computers Courses**

#### **ECEC 301 - Advanced Programming for Engineers**

An advanced introduction to classes and objects; inheritance and polymorphism; abstract classes and interfaces; exception handling; files and streams; garbage collection and dynamic memory allocation; recursion; using linked lists, stacks, queues, and trees; search and sorting algorithms; generic methods and classes; a comparative introduction to dominant programming languages; engineering examples.  
Credits: 3.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
Must be enrolled in one of the following Program Level(s):  
Graduate Quarter  
Undergraduate Quarter  
Pre-Requisites: ECE 203 Minimum Grade: D or CS 203 Minimum Grade:  
D  
Repeat Status: Not repeatable for credit

#### **ECEC 302 - Digital Systems Projects**

Offers hands-on experiences in digital system design with automation tools. Uses field programmable gate arrays in the projects. Some or all pre-requisites may be taken as either a pre-requisite or co-requisite. Please see the department for more information.  
Credits: 4.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: (CS 171 Minimum Grade: D (May be taken concurrently) or ECE 203 Minimum Grade: D or CS 203 Minimum Grade: D ) and ECE 200 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECEC 304 - Design with Microcontrollers**

Offers hands-on experience in the design of controllers that incorporate microcontrollers as an embedded component in a larger system. The microcomputer topics to be studied will include architecture, software, programming and interfaces.  
Credits: 4.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECE 200 Minimum Grade: D and (CS 171 Minimum Grade: D or ECE 203 Minimum Grade: D or CS 203 Minimum Grade: D )  
Repeat Status: Not repeatable for credit

### **ECEC 352 - Secure Comput Sys: Desn Conc**

Covers concepts of secure computation, including economics vs. faults, errors, and hidden messages; mathematical foundations of secure computing; design issues in fault-tolerant computing; and testability and cryptography.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEC 302 Minimum Grade: D and MATH 221 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ECEC 353 - Systems Programming**

This course introduces computer systems, including interaction of hardware and software through the operating system, from the programmer's perspective. Three fundamental abstractions are emphasized: processes, virtual memory, and files. These abstractions provide programmers a common interface to a wide variety of hardware devices. Topics covered include linking, system level I/O, concurrent programming, and network programming.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: CS 265 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ECEC 355 - Computer Organization & Architecture**

This course will cover the principles of designing microprocessors using solid engineering fundamentals and quantitative cost/performance trade-offs. Topics will cover instruction set architectures, arithmetic for computers, assessing and understanding processor performance, processor datapath and control, pipelining, cache design, and virtual-memory design.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: (ECE 200 Minimum Grade: D or CS 270 Minimum Grade: D ) and ECEC 302 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ECEC 356 - Embedded Systems**

Offers hands-on experience with the Motorola 6812 Microcontroller. Involves embedded software development in C and assembly languages. The course covers timer, pulse width modulation and serial communication subsystems. Lab projects include generation of precise waveforms with specified duty cycles, precise measurement of pulse width, interconnection of two microcontrollers, etc.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Graduate Quarter

Undergraduate Quarter

Pre-Requisites: ECEC 304 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ECEC 357 - Introduction to Computer Networks**

History of the Internet; introduction to packet switching, circuit switching and virtual circuit switching; statistical multiplexing; protocol layering; metrics of network performance including bandwidth, delay and loss; medium access protocols and Ethernet; routing algorithms; end-to-end issues; flow and congestion control; an overview of application layer protocols.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECEC 301 Minimum Grade: D or CS 172 Minimum Grade: D

Grade: D

Repeat Status: Not repeatable for credit

### **ECEC 411 - Computer Hardware**

Covers the design and performance of computer hardware devices, including direct memory access, priority arbitration, double buffering, and bus standards. Fall.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: ECEC 355 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ECEC 412 - Modern Processor Design**

This course introduces modern processor design in a systematic manner. It discusses dynamically scheduled superscalar techniques including multi-issue, dynamic instruction scheduling, speculative

execution, and branch prediction; advanced cache designs, and new techniques including SMT and VLIW. The course provides a comprehensive coverage of modern processor architectures.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECEC 355 Minimum Grade: D or CS 281 Minimum

Grade: D

Repeat Status: Not repeatable for credit

#### **ECEC 413 - Introduction to Parallel Computer Architecture**

This course provides an introduction to the fundamental principles and engineering trade-offs involved in designing modern parallel computers (multi-processors). Topics covered include, but are not limited to, shared-memory and message-passing programming, cache-coherence, synchronization, scalable distributed memory multi-processors, and interconnection techniques.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: (ECEC 355 Minimum Grade: D and ECEC 412 Minimum

Grade: D ) or (CS 281 Minimum Grade: D and CS 282 Minimum Grade:

D )

Repeat Status: Not repeatable for credit

#### **ECEC 414 - High Performance Computing**

This course is an introduction to high performance computing, including both concepts and applications. Course contents will include discussions of different types of high performance computer architectures (multi-core/multi-threaded processors, parallel computers, etc.), the design, implementation, optimization and analysis of efficient algorithms for uni-processors, multi-threaded processors, and parallel computers, and high performance programming.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: (CS 281 Minimum Grade: D and CS 283 Minimum

Grade: D ) or (ECEC 353 Minimum Grade: D and ECEC 355 Minimum

Grade: D )

Repeat Status: Not repeatable for credit

#### **ECEC 421 - Intro Operating Sys I**

Covers basic concepts of computer operating systems, including multiprocessing and multiprogramming systems, lock operations, synchronization, and file structures. Winter.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: ECEC 355 Minimum Grade: D and CS 260 Minimum

Grade: D

Repeat Status: Not repeatable for credit

#### **ECEC 422 - Intro Operating Sys II**

Further develops the topics of ECEC 421. Spring.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEC 421 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEC 431 - Intro Computer Networks**

Covers topics in computer and telecommunications network design.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECE 200 Minimum Grade: D and CS 260 Minimum

Grade: D

Repeat Status: Not repeatable for credit

#### **ECEC 432 - Internet Arch and Protocols**

Covers architecture, protocols, and services of the Internet with an analytical approach focused on design principles; Internet architecture and topology; architecture of web and mail servers; router architectures; routing protocols; multicasting; multimedia over IP and associated protocols; Quality-of-Service issues in the Internet.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: ECEC 431 Minimum Grade: D or CS 472 Minimum

Grade: D

Repeat Status: Not repeatable for credit

#### **ECEC 433 - Network Programming**

Covers application layer protocol and how applications use the transport layer; principles and practice of network programming; the client-server model; concurrent processing; introduction to sockets and related functions client and server software design with examples; principles, issues and challenges in e-mail and web application protocols; security protocols; and network life system concepts.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: ECEC 432 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEC 441 - Robot/Comp Intf & Cntl I**

Covers fundamentals of robotics systems, including mechanics, actuators, sensors, kinematics, and inverse kinematics. Fall.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: ECES 356 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEC 442 - Robot/Comp Intf & Cntl II**

Covers robot dynamics, Lagrangian and Newton Euler methods, linear control of robots, path planning, and computer implementation.

Winter.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEC 441 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEC 443 - Robot/Comp Intf & Cntl III**

Covers robot-computer interface methods, including redundancy, optimal control, robustness, nonlinear control, adaptive control, and multiprocessor control. Spring.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEC 442 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEC 451 - Computer Arithmetic**

This course provides an introduction to number representations used in computer arithmetic, issues of complexity in arithmetic operations, fixed point arithmetic, floating point arithmetic, and residue number systems.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECE 200 Minimum Grade: D and ECEC 355 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEC 453 - Image Processing Architecture**

This course covers applications of computing techniques and hardware in image (still and video) processing. Methods of compression (lossless, lossy), video compression, JPEG standards, MPEG standards, processing requirements, and implementations for multimedia.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECE 200 Minimum Grade: D and ECES 302 Minimum Grade: D

Repeat Status: Course can be repeated 0 time(s)

#### **ECEC 455 - Intelligent Sys Architectures**

This course outlines the principles of designing the architectures for intelligent systems. Methods of knowledge representation are compared for a variety of engineering problems. Methods of sensing and behavior generation are demonstrated for applications in large engineering and information systems including autonomous robots. Principles of goal-oriented computers are discussed, and modules of intelligent systems architectures are described. Theoretical fundamentals and practical techniques for learning are also covered.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: MATH 221 Minimum Grade: D and ECEC 355 Minimum Grade: D

Repeat Status: Course can be repeated 0 time(s)

**ECEC 457 - Security in Computing**

The course introduces ideas from Cryptography and Fault Tolerant Computing. Cryptography studies how to artificially create distortions that being interwoven with computations mask them from eavesdropping. Fault Tolerance studies techniques of suppressing effects of natural noises that operate in computation channels. The course deals with both some introductory issues in Public Key Cryptography and some important aspects of designing Fault Tolerant Systems.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: ECEC 451 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECEC 459 - Testing of Hardware**

Testing has become the largest expense item in the semiconductor industry. There is rapidly being developed new techniques in testing, design for test and built-in self-test because no existing set of techniques can satisfy the existing and future needs. The course reviews, in a unified way, important issues in testing and diagnosis of hardware. Together with the "Security in Computing" course, it brings a design engineer student to the state of the art level in the field.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: ECEC 457 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECEC 471 - Introduction to VLSI Design**

This is an introductory course where systematic understanding, design and analysis of digital VLSI integrated circuits will be covered. The course will begin with a review of CMOS transistor operation and semiconductor processes. Logic design with CMOS transistor and circuit families will be described. Specifically, layout, design rules, and circuit simulation will be addressed.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: (ECE 200 Minimum Grade: D or CS 270 Minimum Grade: D ) and (ECEL 301 Minimum Grade: D and ECEL 302 Minimum Grade: D )

Repeat Status: Not repeatable for credit

**ECEC 472 - VLSI Design & Automation**

Design and analysis of VLSI integrated circuits will be covered from circuits and systems design perspectives. First, system timing and

arithmetic building blocks will be presented. Then, design automation will be presented by hierarchical design examples using hardware description languages (HDL) and physical design with VLSI CAD tools.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: (ECE 200 Minimum Grade: D or CS 270 Minimum Grade: D ) and (ECEC 356 Minimum Grade: D or CS 281 Minimum Grade: D )

Repeat Status: Not repeatable for credit

**ECEC 473 - Modern VLSI IC Design**

This is a project-oriented course where a high-complexity VLSI design project will be assigned to student teams. Team-work, task assignment and team communication will be mediated in an industry setting. Design tasks will cover the entire IC design flow range, from system specification to TRL description to timing and power analysis.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECEC 472 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECEC 490 - Special Topics Comp Engr**

Provides special courses offered because of particular student or faculty interest.

Credits: 12.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

**ECEC 497 - Research In Computer Engr**

Computer engineering students only. Requires independent research in a field approved by the faculty.

Credits: .50 to 12.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following Major(s):

Computer Engineering

May not have the following Classification(s):

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)



### **ECEC 499 - Ind Study Computer Engr**

Computer engineering students only. Requires independent study or research in a field approved by the faculty.

Credits: .50 to 12.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following Major(s):

Computer Engineering

May not have the following Classification(s):

Freshman

Sophomore

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

## **Electrical & Computer Engineering: Electrophysics Courses**

### **ECEE 302 - Electronic Devices**

Covers principles of operation of semiconductor devices, including PN diodes, bipolar transistors, and field effect transistors (JFET, MOSFET, MESFET). Applications of PN junctions, including solar cells, led, laser diodes. Laboratories reinforce lecture material by allowing students to build, measure and analyze data from simple devices.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: TDEC 211 Minimum Grade: D or ENGR 220 Minimum

Grade: D

Repeat Status: Not repeatable for credit

### **ECEE 304 - Electromag Fields & Waves**

Covers vector calculus, Coulomb's Law, Gauss' Law, Ampere's Law, Maxwell's equations, Electromagnetic (EM) fields in devices, EM fields in circuits, EM fields in machinery, EM waves, biological effects.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MATH 291 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ECEE 352 - Analog Electronics**

Teaches the fundamentals of electronic circuit analysis and design by means of practical projects, such as a dc power supply and an audio

amplifier. Covers design with discrete components as well as integrated circuit design.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECES 302 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ECEE 354 - Wireless and Optical Electronics**

Covers propagation of waves in various media as it relates to wireless communications: reflection, transmission, polarization, wave packets, dispersion, radiation and antennas, microwave electronic devices, optical wave guides, and fiber optics.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECES 302 Minimum Grade: D and ECEE 304 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ECEE 421 - Advanced Electronics I**

Application-and design-focused course. Analyzes feedback in electronic circuits such as operational amplifiers. Covers design and applications of active filters and other typical electronic circuitry. Includes experiments in the design of multistage transistor circuits, feedback loops, operational amplifiers, and active filters.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEE 352 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ECEE 422 - Advanced Electronic Circuits I**

Application-and design-focused course. Covers analysis and design of communication circuits and non-linear active circuits; oscillators, mixers, IF and RF amplifiers; and AM and FM modulators.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

#### Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEE 421 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEE 423 - Adv Electronic Circuits II**

Application-and design-focused course. Covers non-linear circuits; function and wave form generators; log-amp, multipliers, dividers, power amp, and phase-lock loops; and design of electronics needed to implement different logic circuit families.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEE 421 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEE 434 - Digital Electronics**

Covers basic digital integrated circuit building blocks (inverters, nor and nand logic), CMOS logic gates (dc and transient behavior), drivers, and digital circuits and systems (PLA, gate array, memory). Experiments in semiconductor material characterization, device characterization, circuit and device simulations.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEE 302 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEE 441 - Lightwave Engineering I**

Covers fundamentals of wave propagation, including propagation in various fiber wave guides and field distributions, diffraction, attenuation, dispersion, information capacity, and other analytic and design considerations in fiber systems. Fall.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEE 304 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEE 442 - Lightwave Engineering II**

Covers operating principles, construction, and characteristics of sources, couplers, and detectors used in optical systems. Includes equivalent circuit models and principles of generation, transmission, and reception. Winter.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEE 441 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEE 443 - Lightwave Engineering III**

Covers applications of devices and systems in such areas as data, voice, and image trans-mission; industrial automation; process control; medicine; and computers. Includes basic measurement systems. Spring.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEE 442 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEE 451 - Electroacoustics**

Applications-oriented course. Covers fundamentals of vibrating systems; equations of motion; acoustical, electrical, and mechanical analogs; properties of waves in fluids; acoustic impedance and plane wave transmission; application to design of transducers; and application of acoustic waves in medical imaging, non-destructive testing, and the biomedical field.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Junior

Pre-Junior

Sophomore

Repeat Status: Not repeatable for credit

#### **ECEE 471 - RF Components and Techniques**

This course covers microwave networks (Z, Y, S, T ABCD Parameters), signal flowgraph, impedance matching techniques (lumped and distributed, quarter wave transformers), circulators and isolators,

directional couplers (branch line, Wilkinson, Lange, slot waveguide), and filters (lowpass, bandpass, bandstop, highpass). CAD laboratory and design projects are an integral part of this course.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECEE 354 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEE 472 - RF Electronics**

This course covers static and dynamic characteristics of transistors, unipolar (MOSFET, MESFET, HEMT), bipolar (BJT, HBT), LNA design and realization, power amplifiers, distributed amplifiers, switches, limiters, phase shifters, detectors, mixers, oscillators (Colpitts, YIG turned, reflection, transmission, DRO). CAD laboratory and design projects are an integral part of this course.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECEE 471 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEE 473 - Antennas and Radiating Systems**

This course covers short and magnetic dipole, radiation pattern, radiation resistance, directivity and gain, line antennas (dipoles, monopoles, V and inverted V antennas), helix, Yagi-Uda, log-periodic, aperture antennas (slot, horn and reflector), printed circuit antennas (patch and spiral), and phased antennas. CAD laboratory and design projects are an integral part of this course.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECEE 471 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ECEE 490 - Spec Topics Electrophysic**

Provides special courses offered because of particular student or faculty interest.

Credits: 12.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

#### **ECEE 497 - Research in Electrophysics**

Requires independent research in a topic approved by the faculty.

Credits: .50 to 12.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Course can be repeated 98 time(s) for 998.90 credit(s)

#### **ECEE 499 - Ind Study In Electrophys**

Requires independent study in a topic approved by the faculty.

Credits: .50 to 12.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

### **Electrical & Computer Engineering: Power Engineering Courses**

#### **ECEP 352 - Electric Motor Control Principles**

Introduces machinery principles, magnetic circuits, three-phase circuits, the electrical and economic structure of the power industry, ac and dc machine fundamentals, and power electronic converters and their interfaces with electric motors. Some or all pre-requisites may be taken as either a pre-requisite or co-requisite. Please see the department for more information.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: (ECE 201 Minimum Grade: D or ECES 211 Minimum Grade: D ) and ECEE 302 Minimum Grade: D (May be taken concurrently)

Repeat Status: Not repeatable for credit

#### **ECEP 354 - Energy Management Principles**

Covers principles of power engineering, including the electrical and economic structure of the power industry (distribution, subtransmission, and bulk transmission levels; environmental issues; the electrical system analysis; the thermal system analysis; links between electromechanics and thermodynamics; and safety issues). Some or all pre-requisites may be taken as either a pre-requisite or co-requisite. Please see the department for more information.

Credits: 4.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):  
Freshman  
Pre-Requisites: (ECE 201 Minimum Grade: D or ECES 211 Minimum Grade: D ) and ECEE 302 Minimum Grade: D (May be taken concurrently)  
Repeat Status: Not repeatable for credit

#### **ECEP 411 - Power Systems I**

Covers elements of engineering theory and practice for the transmission of electric energy in a power system network. Includes transmission line parameters and their evaluation; models of short, medium, and long transmission lines; steady-state load-flow studies; real power/frequency control, and reactive power/voltage controls.  
Credits: 3.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):  
Freshman  
Pre-Requisites: ECEP 352 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECEP 412 - Power Systems II**

Covers power system transients, symmetrical components, economic loading of power systems, faults on synchronous machines, short-circuit studies, and transient stability analysis.  
Credits: 4.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):  
Freshman  
Pre-Requisites: ECEP 411 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECEP 413 - Power Systems III**

Covers details of planning and design of major electrical power systems, with emphasis on economic, statistical, and technical considerations.  
Credits: 3.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):  
Freshman

Pre-Requisites: ECEP 412 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECEP 421 - Modeling and Analysis of Electric Power Distribution Systems**

Introduction to power distribution systems; balanced and unbalanced systems, component and load modeling, radial and weekly meshed topologies; algorithms for unbalanced power studies including radial and general structure solver.  
Credits: 3.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
Must be enrolled in one of the following Program Level(s):  
Undergraduate Quarter

May not have the following Classification(s):  
Senior  
Co-Requisites: ECEP 411  
Repeat Status: Not repeatable for credit

#### **ECEP 422 - Power Distribution Automation and Control**

Focuses on distribution management systems and their application: including optimizing network operation - capacitor placement and control, network reconfiguration, service restoration. Modern solution technologies are addressed.  
Credits: 3.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
Must be enrolled in one of the following Program Level(s):  
Undergraduate Quarter

Pre-Requisites: ECEP 421 Minimum Grade: C  
Repeat Status: Not repeatable for credit

#### **ECEP 423 - Service and Power Quality Distribution Systems**

Focus on power distribution systems: service and power quality assessment including stat estimation, voltage quality, trouble call analysis, service restoration, component and system reliability assessment.  
Credits: 3.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
Must be enrolled in one of the following Program Level(s):  
Undergraduate Quarter

Pre-Requisites: ECEP 422 Minimum Grade: C  
Repeat Status: Not repeatable for credit

#### **ECEP 431 - Adv Electromag Energy Conv I**

Covers theory and operation of alternating current machinery, with emphasis on design alternatives and the effects of design on performance. Includes construction of machine models from laboratory measurements.  
Credits: 4.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: ECEP 352 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECEP 432 - Adv Electromag Energy Conv II**

Covers dynamic behavior and transient phenomena of rotating machines and the mathematical models used to describe them, generalized machine theory, measurement of parameters for the mathematical models, and measurement of dynamic and transient behavior.

Credits: 4.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:

May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):  
Freshman

Pre-Requisites: ECEP 431 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECEP 441 - Protective Relaying**

Covers operating principles of electromechanical and static relays, fault clearance, and protection of individual parts of a power system. Some or all pre-requisites may be taken as either a pre-requisite or co-requisite. Please see the department for more information.

Credits: 3.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:

May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):  
Freshman

Pre-Requisites: ECEP 352 Minimum Grade: D and ECEP 411 Minimum Grade: D (May be taken concurrently)  
Repeat Status: Not repeatable for credit

#### **ECEP 451 - Power Electronic Converter Fundamentals**

Fundamentals of power electronics that include waveforms, basic power switch properties and magnetic circuits. Introduction to basic power electronic converter circuits: diode and phase-controlled rectifiers and inverters; switch-mode converters. Applications to DC and AC power supply systems.

Credits: 3.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:

May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):  
Freshman  
Pre-Requisites: ECEP 352 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECEP 452 - Experimental Study of Power Electronic Converters**

Experimental study of common power electronic converters: diode rectifiers, phase-controlled rectifies, switch-mode inverters. Both hardware and software studies. Additional lectures on: Study of DC-DC switch-mode converters.

Credits: 3.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:

Must be enrolled in one of the following Program Level(s):  
Undergraduate Quarter

Pre-Requisites: ECEP 451 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECEP 453 - Applications of Power Electronic Converters**

Provides a first look at various power electronic applications in residential, commercial and industrial sites. Examples include utility application such as static var compensators (SVC), thyristor switch capacitors (TSC), high voltage direct-current (HVDC) transmission systems among others. In addition, fundamentals of motor drives and their controls are covered. Examples include induction, DC synchronous and specialized motors.

Credits: 3.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:

Must be enrolled in one of the following Program Level(s):  
Undergraduate Quarter

Pre-Requisites: ECEP 451 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECEP 461 - High Voltage Laboratory**

Requires students to perform four basic experiments to become familiar with high-voltage techniques and then do a high-voltage design project of their own choosing.

Credits: 1.00

College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:

May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):  
Freshman

Pre-Requisites: ECEP 352 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECEP 471 - Power Seminar I**

Discusses current developments in power system operation and research, concentrating on current and future energy sources.

Credits: .50  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Repeat Status: Not repeatable for credit

#### **ECEP 472 - Power Seminar II**

Discusses current developments in power system operation and research, concentrating on generating stations, transmission lines, and substations.  
Credits: .50  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Repeat Status: Not repeatable for credit

#### **ECEP 473 - Power Seminar III**

Discusses current developments in power system operation and research, concentrating on distribution, security, and economics.  
Credits: .50  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Repeat Status: Not repeatable for credit

#### **ECEP 490 - Special Topics Power Engr**

Provides special courses offered because of particular student or faculty interest.  
Credits: 12.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

#### **ECEP 497 - Research in Power Systems**

Requires independent study in a topic approved by the faculty.  
Credits: .50 to 12.00  
College: College of Engineering

Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Repeat Status: Course can be repeated 98 time(s) for 998.90 credit(s)

#### **ECEP 499 - Ind Study In Power Engr**

Requires independent study in a topic approved by the faculty.  
Credits: .50 to 12.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

### **Electrical & Computer Engineering: Systems Courses**

#### **ECES 302 - Transform Methods and Filtering**

Covers the Fourier series and the Fourier transform, sinusoidal steady-state analysis and filtering, discrete-time systems and the Z-transform, discrete Fourier transform, network functions and stability, magnitude, phase, poles and zeroes, Nyquist criterion, the Nyquist plot and root loci, stability of one-ports, sensitivity, worst-case design and failure-tolerance.  
Credits: 4.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: (TDEC 221 Minimum Grade: D or ENGR 232 Minimum Grade: D or MATH 262 Minimum Grade: D or MATH 210 Minimum Grade: D ) and ECE 201 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECES 304 - Dynamic Systems and Stability**

Covers linear time-invariant circuits and systems; two-and multi-terminal resistors, operational-amplifier circuits, first-order circuits, linear and nonlinear second-order systems, state equation and state variables, eigenvalues and eigenvectors, zero-input response, qualitative behavior of  $x'=Ax$  (stability and equilibria), qualitative behavior of  $x'=f(x)$ , phase portraits, equilibrium states.  
Credits: 4.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: ECES 302 Minimum Grade: D  
Repeat Status: Not repeatable for credit

**ECES 306 - Intro Modulation & Coding**

Covers signal sampling and reconstruction; modulation, angle modulation; digital communications systems, digital transmission.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECES 302 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 352 - Intro Digital Signal Process**

Covers discrete-time signals, analog-digital conversion, time and frequency domain analysis of discrete-time systems, analysis using Z-transform, introduction to digital filters, discrete-time Fourier transform, Discrete Fourier Transform (DFT), and Fast Fourier Transform (FFT).

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECES 302 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 354 - Wireless, Mob & Cellular Comm**

Covers concepts of wireless systems; propagation effects, including loss, dispersion, fading, transmission, and reception; mobile systems, including design of base units and mobile units; micro cells and pico cells; cell division, including frequency use and reuse; concepts of FDMA, TDMA, and CDMA; error rates and outage probability; and circuits and components for wireless and mobile systems.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECES 306 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 356 - Theory of Control**

Covers the foundations of control theory. Includes experiments and demonstrations during lectures and labs that may be jointly held, taking advantage of multimedia and computer-controlled apparatus.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECES 304 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 358 - Computer Control Systems**

Reviews principles of applications of computer control systems to a variety of industries and technologies, including manufacturing processes, robotic cells, machine cells, chemical processes, network control, investment portfolio control, and real-time expert and learning systems for diagnostics and quality control.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECES 356 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 421 - Communications I**

Covers analog communications, including linear modulation methods (AM, DSB, SSB), exponential modulation (FM, PM), and noise effects on analog communication systems.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECES 306 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 422 - Communications II**

Covers analog (PAM, PPM) and digital (PCM, DM) pulse modulation systems, entropy, source coding, and channel coding.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECES 421 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 423 - Communications III**

Covers digital transmission systems, baseband and passband, spread-spectrum communications, and basics of wireless and mobile systems.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECES 422 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 434 - Deterministic Signal Processg**

This course combines the media of speech and image analysis to introduce the most basic elements in digital signal processing. It will introduce students to the interdisciplinary aspect of DSP by using hands-on experiments drawn from diverse disciplines such as medicine, optical character recognition, speech synthesis and recognition; assembly automation and inspection, etc. Matlab-based multimedia programming software for a number of image/speech processing applications will be used to unburden the computational tasks of future course offerings.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECES 352 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 435 - Statistical Signal Processing**

The representation of a stationary random process by its spectrum can be an efficient and revealing description of the process. Spectral analysis is used to detect periodicities in the data, and is quite powerful in signal processing tasks such as data modeling, forecasting, system identification and signal detection. The course covers state-of-the-art, as well as conventional, power spectrum estimation techniques. Students will have theoretical as well as working knowledge necessary to evaluate and use existing DSP techniques and tools as well as competence to develop novel discrete-time signal processing methods.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECES 434 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 436 - Speech and Image Sig Interpret**

This course presents speech production modeling material and includes an overview of the anatomy of speech production, a digital model for vowel sounds, short term LPC analysis, cepstral analysis, and an introduction to speech coding. Image modeling and recognition material includes definitions of edges, boundaries, and textures, recognition and shape estimation from contours and textures, recognition and shape estimation from stereo, and motion and object tracking.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECES 435 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 444 - Systems and Control I**

This course reviews classical control: analysis and design, state space approach to systems analysis and control; Eigenvalue/Eigenvector analysis, model decomposition, state space solutions and Cayley-Hamilton technique and applications.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECES 356 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 445 - Systems and Control II**

This course covers Eigenvector single-value decomposition and modal decomposition; controllability, observability and Kalman canonical forms; state controllers and observers and the separation principle.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECES 444 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECES 446 - Systems and Control III**

This course covers linear quadratic control, non-linear stability and analysis. Current topics in control include Robust, H-infinity, and Fuzzy Control concepts.

Credits: 4.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECES 445 Minimum Grade: D

Repeat Status: Not repeatable for credit



**ECES 490 - Special Tops Systems Engr**

Provides special courses offered because of particular student or faculty interest.

Credits: 12.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites:

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

**ECES 497 - Research In Systems Engr**

Electrical engineering students only. Requires independent research in a topic approved by the faculty.

Credits: .50 to 12.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

**ECES 499 - Sup Study: Sys Engineering**

Requires independent study in a topic approved by the faculty.

Credits: .50 to 20.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Not repeatable for credit

**Electrical & Computer Engineering Courses****ECE 200 - Digital Logic Design**

Number systems and representation, two's complement arithmetic, digital logic devices, switching algebra, truth tables, minimization of Boolean functions, combinational logic design and analysis, sequential circuit analysis and design.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CS 170 Minimum Grade: D or TDEC 132 Minimum

Grade: D or CS 171 Minimum Grade: D or ENGR 103 Minimum Grade: D or ENGR 104 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECE 201 - Foundations of Electric Circuits**

Covers basic electric circuit concepts and laws; circuit theorems; mesh and node methods; analysis of first-and second-order electric circuits; force and natural response; sinusoidal steady state analysis; complex frequency.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following Major(s):

Commerce and Engineering

May not have the following Classification(s):

Freshman

Pre-Requisites: PHYS 211 Minimum Grade: D or TDEC 115 Minimum

Grade: D or PHYS 281 Minimum Grade: D or PHYS 102 Minimum Grade: D

Repeat Status: Not repeatable for credit

**ECE 203 - Programming for Engineers**

Fundamentals of computer organization; rudiments of programming including data types, arithmetic and logical expressions, conditional statements, control structures; problem solving techniques for engineers using programming; object-oriented programming; arrays; simulation of engineering systems; principles of good programming practice.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

May not have the following Classification(s):

Freshman

Repeat Status: Not repeatable for credit

**ECE 211 - Electrical Engr Principles**

Not open to electrical or mechanical engineering students. Covers basic techniques of electric circuit analysis, electronic devices, amplifiers, operational amplifier, and fundamentals of instrumentation.

Credits: 3.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following Major(s):

Electrical Engineering  
Mechanical Engineering  
May not have the following Classification(s):  
Freshman

Co-Requisites: ECE 212  
Pre-Requisites: (MATH 201 Minimum Grade: D or ENGR 231 Minimum Grade: D or MATH 261 Minimum Grade: D ) and (PHYS 211 Minimum Grade: D or PHYS 281 Minimum Grade: D or PHYS 102 Minimum Grade: D )  
Repeat Status: Not repeatable for credit

#### **ECE 212 - Electrical Engr Princ Lab**

Not open to electrical or mechanical engineering students. Includes experiments involving concepts discussed in ECE 211  
Credits: 1.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not be enrolled in one of the following Major(s):  
Electrical Engineering  
Mechanical Engineering  
May not have the following Classification(s):  
Freshman  
Co-Requisites: ECE 211  
Repeat Status: Not repeatable for credit

#### **ECE 491 - Senior Design Project I**

Introduces the design process, including information retrieval, problem definition, proposal writing, patents, and design notebooks. Includes presentations on problem areas by experts from industry, government, and education. This is a writing intensive course.  
Credits: 2.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Must have the following Classification(s):  
Senior  
Repeat Status: Not repeatable for credit

#### **ECE 492 - Senior Design Project II**

Continues ECE 491. Requires written and oral progress reports. This is a writing intensive course.  
Credits: 2.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Must have the following Classification(s):  
Senior  
Pre-Requisites: ECE 491 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **ECE 493 - Senior Design Project III**

Continues ECE 492. Requires written and oral final reports, including oral presentations by each design team at a formal Design Conference open to the public and conducted in the style of a professional conference.  
Credits: 4.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Must have the following Classification(s):  
Senior  
Pre-Requisites: ECE 492 Minimum Grade: D  
Repeat Status: Not repeatable for credit

### **Electrical Engineering Lab Courses**

#### **ECEL 301 - Electrical Engineering Laboratory**

Offers laboratory experiences in each of the five ECE tracks: computers, controls/robotics, electronics, power and energy, and telecommunications. Each lab consists of a stand-alone module containing: lecture material providing basic theory, references, and laboratory experiments. This is a writing intensive course.  
Credits: 2.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: ECE 200 Minimum Grade: D and ECE 201 Minimum Grade: D and (TDEC 132 Minimum Grade: D or TDEC 133 Minimum Grade: D or ENGR 104 Minimum Grade: D or ENGR 103 Minimum Grade: D )  
Repeat Status: Not repeatable for credit

#### **ECEL 302 - ECE Laboratory II**

Offers laboratory experiences in each of the five ECE tracks: computers, controls/robotics, electronics, power and energy, and telecommunications. Each lab consists of a stand-alone module containing: lecture material providing basic theory, references, and laboratory experiments. Some or all pre-requisites may be taken as either a pre-requisite or co-requisite. Please see the department for more information.  
Credits: 2.00  
College: College of Engineering  
Department: Electrical & Computer Engr  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman

Pre-Requisites: ECEL 301 Minimum Grade: D and ECES 302 Minimum Grade: D (May be taken concurrently)  
Repeat Status: Not repeatable for credit

### **ECEL 303 - ECE Laboratory III**

Covers basic digital signal processing concepts, an introduction to analog-to-digital and digital-to-analog converters, and power supply design using analog IC devices.

Credits: 2.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ECEL 301 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ECEL 304 - ECE Laboratory IV**

This course offers laboratory experience, using both modeling software and digital and analog hardware relevant to both electrical and computer engineers. Multi-week design projects and design teams are used to prepare students for Senior Design work.

Credits: 2.00

College: College of Engineering

Department: Electrical & Computer Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ECEL 303 Minimum Grade: D

Repeat Status: Not repeatable for credit

## **Engineering, General Courses**

### **ENGR 100 - Beginning CAD for Design**

Introduces students to computer-aided graphics techniques and the use of a state-of-the-art, computer-aided design/drafting package.

Students will learn 2-D and 3-D modeling techniques to support the design process. All students will be required to take a competency quiz on 4 of 6 available AutoCAD labs.

Credits: 1.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

Sch.of Biomed Engr,Sci & Hlth

Repeat Status: Not repeatable for credit

### **ENGR 101 - Engineering Design Laboratory I**

This course introduces students to engineering design and practice. Emphasis is placed on the synthesis of knowledge, skills and the methodologies that are the heart of the profession. The course is designed to integrate core scientific foundations into an engineering perspective through the use of team-based projects, computer tools and technical writing. This is the first part of the three term freshman design experience.

Credits: 2.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

Sch.of Biomed Engr,Sci & Hlth

Repeat Status: Not repeatable for credit

### **ENGR 102 - Engineering Design Laboratory II**

This course introduces students to engineering design and practice. Emphasis is placed on the synthesis of knowledge, skills and the methodologies that are the heart of the profession. The course is designed to integrate core scientific foundations into an engineering perspective through the use of team-based projects, computer tools and technical writing. This is the second part of the three term freshman design experience.

Credits: 2.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

Sch.of Biomed Engr,Sci & Hlth

May not have the following Classification(s):

Repeat Status: Not repeatable for credit

### **ENGR 103 - Engineering Design Laboratory III**

This course introduces students to engineering design and practice. Emphasis is placed on the synthesis of knowledge, skills and the methodologies that are the heart of the profession. The course is designed to integrate core scientific foundations into an engineering perspective through the use of team-based projects, computer tools and technical writing. This is the third part of the three term freshman design experience.

Credits: 2.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

Sch.of Biomed Engr,Sci & Hlth

May not have the following Classification(s):

Repeat Status: Not repeatable for credit

**ENGR 104 - Engineering Design Lab - Transfers**

Individualized course specially designed for transfer students. Provides selected educational experiences in engineering design, experimental techniques, and computer skills to round out the student's previous course of study.

Credits: 4.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

Sch.of Biomed Engr,Sci & Hlth

Repeat Status: Not repeatable for credit

**ENGR 180 - Special Topics in Engineering**

Topics of special interest to students and faculty in Engineering.

Credits: 12.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

**ENGR 199 - Prep For Engr Studies**

Preparation for the Engineering Core Curriculum through intensive, coordinated work in three areas: pre-calculus mathematics, effective study methods, and career evaluation and selection. Topics include: algebra, trigonometry, geometry, note-taking, exam preparation, time management, evaluation of engineering and other career paths. (This course does not count toward graduation requirements )

Credits: 6.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Not repeatable for credit

**ENGR 201 - Evaluation & Presentation of Experimental Data I**

Provide a comprehensive introduction to analysis, presentation, and communication of data collected by the engineer. Requires students to conduct experiments on engineering systems, then process and evaluate the collected data. Required presentation of research, results, conclusions, and conjectures from a technical and ethical viewpoint.

Credits: 3.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

Sch.of Biomed Engr,Sci & Hlth

May not have the following Classification(s):

Freshman

Co-Requisites: EXAM 081

Pre-Requisites: (MATH 122 Minimum Grade: D and PHYS 101 Minimum

Grade: D and ENGR 103 Minimum Grade: D ) or (TDEC 112 Minimum

Grade: D and TDEC 113 Minimum Grade: D and TDEC 132 Minimum

Grade: D )

Repeat Status: Not repeatable for credit

**ENGR 202 - Evaluation & Presentation of Experimental Data II**

A continuation of ENGR 201

Credits: 3.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

Sch.of Biomed Engr,Sci & Hlth

May not have the following Classification(s):

Freshman

Co-Requisites: EXAM 081

Pre-Requisites: ENGR 201 Minimum Grade: D or TDEC 231 Minimum

Grade: D

Repeat Status: Not repeatable for credit

**ENGR 210 - Introduction to Thermodynamics**

Introduces thermodynamics from a classical point of view. Covers work, heat, entropy, thermodynamic properties, equations of state, and first and second law analysis of closed systems, control volumes, and selected thermodynamic cycles.

Credits: 3.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Co-Requisites: EXAM 081

Pre-Requisites: MATH 122 Minimum Grade: D and PHYS 101 Minimum

Grade: D

Repeat Status: Not repeatable for credit

**ENGR 220 - Fundamentals of Materials**

Introduces materials and their properties; atomic view and architecture of solids; atomic motion in solids, mechanical, magnetic, electrical and optical properties of materials. Corrosion and degradation of solids.

Credits: 4.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not have the following Classification(s):

Co-Requisites: EXAM 081

Pre-Requisites: (CHEM 102 Minimum Grade: D and MATH 122 Minimum Grade: D and PHYS 101 Minimum Grade: D ) or (TDEC 121 Minimum Grade: D and TDEC 112 Minimum Grade: D and TDEC 112 Minimum Grade: D and TDEC 113 Minimum Grade: D )  
Repeat Status: Not repeatable for credit

### **ENGR 231 - Linear Engineering Systems**

Provides an overview of systems and modeling; specifically using linear algebra as the model. Specific emphasis will be placed on developing models of engineering systems and the use of computational tools for solutions of the problems. The focus of the lab will be the use of MATLAB for solution of contemporary engineering problems.

Credits: 3.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Co-Requisites: EXAM 081

Pre-Requisites: MATH 122 Minimum Grade: D or TDEC 112 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ENGR 232 - Dynamic Engineering Systems**

Provides an overview of dynamic systems and modeling; specifically using differential equations as a model. Specific emphasis will be placed on developing models of dynamic systems and the use of computational tools for solutions of the problems. The focus of the lab will be the use of MATLAB for solution of contemporary engineering problems.

Credits: 3.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Co-Requisites: EXAM 081

Pre-Requisites: ENGR 231 Minimum Grade: D or MATH 261 Minimum Grade: D or MATH 201 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ENGR 280 - Introduction to Global Engineering**

Introduces students to a broad range of contemporary issues (economic, political, and cultural) engineers face in meeting the challenges of globalization. In addition to responding to weekly presentations, students will engage in and report on an in-depth case study.

Credits: 2.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Not repeatable for credit

### **ENGR 361 - Statistical Analysis of Engineering Systems**

Probability, random variables, reliability, quality control, design of experiments, regression/correlation, ANOVA and related topics, hypothesis testing.

Credits: 3.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

May not have the following Classification(s):

Freshman

Sophomore

Repeat Status: Not repeatable for credit

### **ENGR 491 - Senior Project Design I**

Introduces the design process, including information retrieval, problem definition, proposal writing, patents, and design notebooks. Includes presentations on problem areas by experts from industry, government, and education.

Credits: 2.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Not repeatable for credit

### **ENGR 492 - Senior Project Design II**

Continues ENGR 491. Requires written and oral progress reports.

Credits: 2.00

College: College of Engineering

Department: Office of Dean of COE

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: CIVE 491 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **ENGR 493 - Senior Project Design III**

Continues ENGR 492. Requires written and oral final reports, including oral presentations by each design team at a formal Design Conference open to the public and conducted in the style of a professional conference.

Credits: 4.00  
College: College of Engineering  
Department: Office of Dean of COE  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Repeat Status: Not repeatable for credit

## Environmental Engineering Courses

### ENVE 300 - Introduction to Environmental Engineering

Overview of environmental engineering practice: water resources, water and waste control, solid waste, air pollution, risk management and environmental health. Population and resource demand forecasting, chemistry and microbiology necessary to solve basic problems is included.

Credits: 3.00  
College: College of Engineering  
Department: Environmental Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: CAEE 201 Minimum Grade: D  
Repeat Status: Not repeatable for credit

### ENVE 302 - Environmental Transport and Kinetics

Covers applications of mass balances to describing transport environmental systems, diffusive and dispersive processes, and coupling of transport and kinetic models.

Credits: 3.00  
College: College of Engineering  
Department: Environmental Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: CHE 201 Minimum Grade: D  
Repeat Status: Not repeatable for credit

### ENVE 335 - Industrial Safety

Examines safety in the workplace, loss prevention principles, Occupational Safety and Health Act implementation, accident investigation techniques, and basics of loss control and risk management.

Credits: 3.00  
College: College of Engineering  
Department: Environmental Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):

Freshman  
Repeat Status: Not repeatable for credit

### ENVE 410 - Solid and Hazardous Waste

Provides an overview of municipal and industrial waste management, including design and economic analysis. Discusses options such as landfilling and incineration from engineering, social, and regulatory perspectives. Reviews physical, chemical, and biological treatment of hazardous waste.

Credits: 3.00  
College: College of Engineering  
Department: Environmental Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Repeat Status: Not repeatable for credit

### ENVE 421 - Water and Waste Treatment II

Covers processes used for water purification and waste treatment, containment and immobilization of hazardous wastes, and ultimate disposal of residues and hazardous materials.

Credits: 3.00  
College: College of Engineering  
Department: Environmental Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Must have the following Classification(s):  
Senior  
Repeat Status: Not repeatable for credit

### ENVE 422 - Water/Waste Treatment Design

Covers integration of processes into a complete treatment system. Includes detailed design procedures to control wastes, prevent environmental contamination, and protect drinking water quality.

Credits: 3.00  
College: College of Engineering  
Department: Environmental Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: ENVE 421 Minimum Grade: D  
Repeat Status: Not repeatable for credit

### ENVE 435 - Groundwater Remediation

Reviews physical, chemical, and biological remediation technologies for contaminated sites and groundwater by in-site and ex-site applications.

Credits: 3.00  
College: College of Engineering  
Department: Environmental Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Not repeatable for credit

#### **ENVE 450 - Data-based Engineering Modeling**

This course covers empirical methods to understand and model engineering systems. Students will learn to develop evaluate statistical models and use three common statistical software packages, Excel, SPSS, and R.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not have the following Classification(s):

Freshman

Junior

Pre-Junior

Sophomore

Pre-Requisites: ENGR 361 Minimum Grade: D or CHE 335 Minimum

Grade: D or MEM 361 Minimum Grade: D or MATH 311 Minimum

Grade: D

Repeat Status: Not repeatable for credit

#### **ENVE 455 - Geographic Information Systems**

The course provides grounding in fundamental principles of GIS, and achieves understanding through hands on practical laboratories.

Course topics include: spatial reference systems, geographic data theory and structures, structures, spatial analysis tools, functions and algorithms, GIS data sources, compilation and quality, and GIS project design and planning.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Repeat Status: Not repeatable for credit

#### **ENVE 460 - Fund Air Poll Control**

Fundamental topics with regard to the formation and control of air pollutants are studied. This course provides strong foundation for engineers who will be involved in the development of engineering solutions for industrial air pollution prevention and design, development or selection of air pollution control devices and systems.

Credits: 3.00

College: College of Engineering

Department: Environmental Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Not repeatable for credit

#### **ENVE 465 - Indoor Air Quality**

Introduces basic concepts about indoor air quality, indoor air pollutants, including their sources and health effects, transport of pollutants, modeling of pollutant concentration in buildings, and ventilation as well as air cleaning systems.

Credits: 3.00

College: College of Engineering

Department: Civil, Arch, & Environ Engr

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: ENVE 302 Minimum Grade: D or AE 220 Minimum

Grade: D

Repeat Status: Not repeatable for credit

#### **ENVE 480 - Topics in Envr Engineering**

Selected topics offered in the area of Environmental Engineering of interest to students or faculty.

Credits: .50 to 12.00

College: College of Engineering

Department: Environmental Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Course can be repeated 98 time(s)

#### **ENVE 485 - Professional Environmental Engineering Practice**

Professional and ethical considerations in environmental engineering practice. Career management and lifelong learning.

Credits: 1.00

College: College of Engineering

Department: Environmental Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following Major(s):

Environmental Engineering

Must have the following Classification(s):

Senior

Repeat Status: Not repeatable for credit

#### **ENVE 486 - Environmental Engineering Processes Laboratory I**

Laboratory experiments on common environmental engineering unit processes are performed. Students use data to draw conclusions relevant to design of full-scale systems.

Credits: 2.00

College: College of Engineering

Department: Environmental Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following Major(s):

Environmental Engineering

Must have the following Classification(s):

Senior

Pre-Requisites: ENVE 302 Minimum Grade: D and ENVE 401 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ENVE 487 - Environmental Engineering Processes Laboratory II**

Laboratory experiments on common environmental engineering unit processes are performed. Students use data to draw conclusions relevant to design of full-scale systems. Continuation of ENVE 486.

Credits: 2.00

College: College of Engineering

Department: Environmental Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following Major(s):

Environmental Engineering

Must have the following Classification(s):

Senior

Pre-Requisites: ENVE 486 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **ENVE 491 - Senior Project Design I**

Introduces the design process. Covers information retrieval, problem definition, proposal writing, patents, and design notebooks. Explores problem areas through presentations by experts from industry, government, and education. This is a writing intensive course.

Credits: 3.00

College: College of Engineering

Department: Environmental Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following College(s)/School(s):

May not have the following Classification(s):

Senior

Pre-Requisites: ENVE 302 Minimum Grade: D

Repeat Status:

#### **ENVE 492 - Senior Design Project II**

Continues the work started in ENVE 491. Requires written and oral progress reports. This is a writing intensive course.

Credits: 3.00

College: College of Engineering

Department: Environmental Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following College(s)/School(s):

May not have the following Classification(s):

Senior

Pre-Requisites: ENVE 491 Minimum Grade: D

Repeat Status:

#### **ENVE 493 - Senior Design Project III**

This course is the final sequence in the design project. It requires written and oral final reports, including oral presentations by each design team at a formal Design Conference open to the public and conducted in the style of a professional conference. This is a writing intensive course.

Credits: 4.00

College: College of Engineering

Department: Environmental Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not be enrolled in one of the following College(s)/School(s):

Must have the following Classification(s):

Senior

Pre-Requisites: ENVE 492 Minimum Grade: D

Repeat Status:

### **Materials Engineering Courses**

#### **MATE 100 - Materials for Emerging Technologies**

Evolution of materials engineering; education and the profession; concepts, tools, and techniques; selection and design using metals, ceramics, polymers, and composites; application of materials in a technological society; and materials of the future.

Credits: 2.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Not repeatable for credit

#### **MATE 101 - Fundamentals of Materials**

Examines principles underlying structure, properties, and behavior of engineering materials, including metals, ceramics, and polymers. Covers topics including bonding; crystal structure; defect structure; alloying; mechanical, electronic, and magnetic properties in relation to structure; phase equilibria; phase transformations; and oxidation and corrosion. All terms.

Credits: 4.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: (CHEM 103 Minimum Grade: D or CHEM 163 Minimum Grade: D ) and (CHEM 102 Minimum Grade: D or CHEM 162 Minimum Grade: D )

Repeat Status: Not repeatable for credit

#### **MATE 214 - Introduction to Polymers**

Covers polymer molecular structure, polymerization methods, semi-crystalline polymers, glass transition, polymer solution in blends, mechanical properties, and characterization methods.

Credits: 4.00

College: College of Engineering

Department: Materials Sci and Engineering



Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: MATE 221 Minimum Grade: D and (MATH 201 Minimum Grade: D or MATH 261 Minimum Grade: D or ENGR 231 Minimum Grade: D ) and CHEM 241 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **MATE 221 - Introduction to Mechanical Behavior of Materials**

Covers mechanics of materials, materials under load, application to materials testing, rate-dependent response to materials, fracture materials, fatigue behavior, manufacturing, and materials processing.

Credits: 3.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: TDEC 211 Minimum Grade: D or ENGR 220 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MATE 240 - Thermodynamics of Materials**

Covers the fundamental laws of thermodynamics, statistical meaning of entropy, thermodynamic functions, heat capacity, reactions in gases and condensed phases, phase diagrams, solutions, and reaction equilibria in condensed solutions.

Credits: 4.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MATE 221 Minimum Grade: D and (TDEC 202 Minimum Grade: D or ENGR 210 Minimum Grade: D )

Repeat Status: Not repeatable for credit

#### **MATE 245 - Kinetics of Materials**

Covers chemical reaction kinetics, thermodynamics and structure of crystal defects, diffusion equations and numerical methods of solution, kinetics in interfacial phenomena, and diffusional transformations.

Credits: 4.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MATE 240 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MATE 280 - Advanced Materials Laboratory**

The goal of the course is to introduce students to state-of-the-art experimental techniques for analysis of structure, composition and properties of materials. Electron microscopy, Raman spectroscopy, indentation and thermal analysis will be described.

Credits: 4.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: (TDEC 212 Minimum Grade: D or ENGR 220 Minimum Grade: D ) and (TDEC 232 Minimum Grade: D or ENGR 202 Minimum Grade: D )

Repeat Status: Not repeatable for credit

#### **MATE 315 - Processing Polymers**

Covers polymer processing, viscous flow and melt rheology, injection molding, extrusion, mechanical behavior, and applications and design.

Credits: 4.50

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MATE 214 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MATE 341 - Defects in Solids**

Main classes of crystalline defects: vacancies, dislocations, stacking faults, surfaces, grain boundaries, geometry, energy considerations, and movement of defects. Defects in specific crystallographic systems.

Credits: 3.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following Major(s):

Materials Engineering

Pre-Requisites: MATE 355 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MATE 345 - Processing of Ceramics**

Covers powder production, materials characterization, stability of powder suspensions, rheological and viscoelastic properties of slurries, green-body consolidation, drying, sintering, and structure-property relationships.

Credits: 4.50

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):  
Freshman  
Pre-Requisites: MATE 340 Minimum Grade: D  
Repeat Status: Not repeatable for credit

**MATE 355 - Structure and Characterization of Crystalline Materials**  
Bonding in solids; classification of metals, semiconductors, and insulators; crystal systems; crystallographic systems in specific engineering materials, relationships, X-ray generation, X-ray absorption and emission; reciprocal space; geometric representation of crystals, small and wide angle scattering, electron microscope imaging and diffraction.  
Credits: 3.00  
College: College of Engineering  
Department: Materials Sci and Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Must be enrolled in one of the following Major(s):  
Materials Engineering  
Pre-Requisites: ENGR 220 Minimum Grade: D and MATE 221 Minimum Grade: D  
Repeat Status: Not repeatable for credit

**MATE 366 - Processing of Metallic Materials**  
Covers solidification processing, casting and welding, heat flow analysis, solid-state transformations, precipitation hardening, transformations in steels, martensite transformations, and industrial case studies. This is a writing intensive course.  
Credits: 4.50  
College: College of Engineering  
Department: Materials Sci and Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: MATE 245 Minimum Grade: D and MATE 360 Minimum Grade: D  
Repeat Status: Not repeatable for credit

**MATE 370 - Mechanical Behavior of Solids**  
Covers continuum mechanics: three-dimensional stress and strain, hydrostatic and deviatoric components, and isotropic elasticity; Mises yield criterion; fracture criteria; linear elastic fracture mechanics; materials selection; defect-tolerant and defect-free fatigue design; notch effects; and statistics of variation.  
Credits: 3.00  
College: College of Engineering  
Department: Materials Sci and Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman

Pre-Requisites: MATE 221 Minimum Grade: D and ENGR 231 Minimum Grade: D  
Repeat Status: Not repeatable for credit

**MATE 410 - Case Studies in Materials**  
Covers interaction of materials processing and design, materials selection, the design-failure interface, cost and capacity in manufacturing. Taught via case studies.  
Credits: 3.00  
College: College of Engineering  
Department: Materials Sci and Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: MATE 221 Minimum Grade: D  
Repeat Status: Not repeatable for credit

**MATE 455 - Biomedical Materials**  
Familiarizes students with natural tissues and the implants designed to replace them, treating both components as engineering materials. Includes a review of fundamental topics of materials structure and testing, and case studies.  
Credits: 3.00  
College: College of Engineering  
Department: Materials Sci and Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Repeat Status: Not repeatable for credit

**MATE 458 - Advanced Biomaterials**  
Tissue Engineering, matrices, cells, scaffold, engineering properties, constitutive relations, absorbable polymers, cell seeding, cellular isolation, cell-scaffold interaction. May be repeated for credit.  
Credits: 3.00  
College: College of Engineering  
Department: Materials Sci and Engineering  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Must have the following Classification(s):  
Senior  
Repeat Status: Course can be repeated 98 time(s) for 998.00 credit(s)

**MATE 460 - Engineering Computational Laboratory**  
Covers numerical techniques, finite differences and finite elements, convergence, and applications in engineering design.  
Credits: 4.00  
College: College of Engineering  
Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MATE 221 Minimum Grade: D and (TDEC 222 Minimum Grade: D or ENGR 232 Minimum Grade: D ) and (TDEC 114 Minimum Grade: D or MATH 200 Minimum Grade: D )

Repeat Status: Not repeatable for credit

**MATE 491 - Senior Project Design I**

Introduces the design process, including information retrieval, problem definition, proposal writing, patents, and design notebooks. Includes presentations on problem areas by experts from industry, government, and education. This is a writing intensive course.

Credits: 2.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Repeat Status: Not repeatable for credit

**MATE 492 - Senior Project Design II**

Continues MATE 491. Requires written and oral progress reports.

Credits: 2.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MATE 491 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MATE 493 - Senior Project Design III**

Continues MATE 492. Requires written and oral final reports, including oral presentations by each design team at a formal Design Conference open to the public and conducted in the style of a professional conference. This is a writing intensive course.

Credits: 4.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MATE 492 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MATE 495 - Special Topics in Materials**

By arrangement. Covers selected topics of current interest in materials engineering. May be taken for multiple course credit.

Credits: .50 to 12.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

**MATE 499 - Independent Study**

Provides independent study and/or research on a topic approved by the department.

Credits: .50 to 12.00

College: College of Engineering

Department: Materials Sci and Engineering

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

**Mechanical Engineering & Mechanics Courses**

**MEM 201 - Foundations of Computer Aided Design**

Covers application of modern, computer-aided graphics techniques and the use of state-of-the-art, computer-aided design/drafting package(s). Includes topics such as principles of computer-aided design/drafting and interactions with computer-aided manufacturing, rapid prototyping, and other modern manufacturing processes; engineering graphics and graphics languages in computer-aided design and/or drafting; creation of a drawing environment; database and file management, editing, modification, displaying, dimensioning, plotting and printing; special editing techniques; 3-D modeling, solid modeling, shading, and rendering; and file transfer. Students must have Sophomore class standing.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites:

Repeat Status: Not repeatable for credit

**MEM 202 - Engineering Mechanics-Statics**

Covers intermediate static mechanics, an extension of the fundamental concepts and methods of static mechanics introduced in the freshman courses TDEC 111, TDEC 113, and TDEC 115. Includes topics such as problem formulation and solution methods; two- and three-dimensional vector representation of forces, moments and couples;

static equilibrium of particles, rigid bodies, and engineering structures; analysis of external and internal forces in structures via methods of free body diagrams; and properties of cross-sectional areas.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: PHYS 185 Minimum Grade: D or PHYS 111 Minimum

Grade: D or PHYS 101 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **MEM 220 - Basic Fluid Mechanics**

Covers general physical properties of a fluid; kinetics of fluid motion; material derivative, vorticity, strain, and dynamics of fluids; and derivation of conservation laws in control volume form with applications.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: TDEC 114 Minimum Grade: D or MATH 189 Minimum

Grade: D or MATH 200 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **MEM 230 - Mechanics of Materials I**

Covers definitions of stress and strain, uniaxial loading, torsion, bending moments and shear forces in beams, bending stresses and shear stress in beams, and stress transformation.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 202 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **MEM 238 - Dynamics**

Covers kinematics and kinetics in two and three-dimensional space, force and acceleration, linear and angular momentum, and energy methods.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: (MATH 189 Minimum Grade: D or MATH 200 Minimum Grade: D ) and (PHYS 111 Minimum Grade: D or PHYS 185 Minimum Grade: D or PHYS 101 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### **MEM 255 - Introduction to Controls**

Introduces the concepts of modeling of mechanical, electrical, electromechanical, thermal, and hydraulic systems; linearization; state-space model; time-domain analysis; transfer functions; frequency-domain analysis; analysis of systems involving automatic control of position, speed, power, flow, pressure, temperature, and other physical quantities; basic concept of feedback; basic concept of stability; computer-aided analysis.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 238 Minimum Grade: D and (MATH 201 Minimum

Grade: D or MATH 261 Minimum Grade: D or ENGR 231 Minimum

Grade: D ) and (MATH 210 Minimum Grade: D or MATH 262 Minimum

Grade: D or ENGR 232 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### **MEM 304 - Intro to Biomechanical Eng**

An overview of the application of mechanical engineering to biological systems. Covers basic anatomy and physiology; tissue, joint, cell, and protein mechanics; joint kinematics; biofluid mechanics; biothermodynamics; biotransport; biomimetic controls; and biomanufacturing.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: MATH 200 Minimum Grade: D and PHYS 101 Minimum

Grade: D and CHEM 102 Minimum Grade: D and BIO 141 Minimum

Grade: D

Repeat Status: Not repeatable for credit

### **MEM 310 - Thermodynamic Analysis I**

Reviews first and second laws of thermodynamics as applied to closed systems, control volumes, and thermodynamic cycles; covers thermodynamic relations and properties of real fluids, mixtures, and solutions; introduces phase and chemical equilibrium, power and refrigeration cycles, and combustion.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ENGR 210 Minimum Grade: D or MEM 210 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **MEM 311 - Thermal & Fluid Sci Lab**

Introduces modern laboratory techniques, including statistical analysis of experimental data; thermodynamic properties and equations of state; and dynamic and static temperature measurements with potentiometers, bridge circuits, and oscilloscopes. Fall.

Credits: 2.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 220 Minimum Grade: D and MEM 310 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **MEM 320 - Fluid Dynamics I**

Covers equation of motion for compressible flow; static, total, and stagnation concepts; one-dimensional isentropic, normal shock, including Fanno and Rayleigh flows and choked flow; two-dimensional supersonic flow, including Prandtl-Meyer flow and oblique shocks; analysis and design of compressible flow devices, including supersonic nozzles, diffusers, wind tunnels, inlets, and combustors.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 220 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **MEM 330 - Mechanics of Materials II**

Reviews mechanics of materials, beam theory, combined loading, stress transformation, shear center, asymmetrical bending, deflection of beams, statically indeterminate beams, energy methods, inelastic bending, and beam column instability.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 230 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **MEM 331 - Experimental Mechanics I**

Covers static testing methods, including strain gages, extensometers, photoelasticity, and model analysis; practical applications of experimental stress analysis; and verification of standard materials tests, including tensile, shear, and buckling. Winter. Some or all pre-requisites may be taken as either a pre-requisite or co-requisite. Please see the department for more information.

Credits: 2.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 230 Minimum Grade: D and MEM 238 Minimum

Grade: D (May be taken concurrently)

Repeat Status: Not repeatable for credit

### **MEM 345 - Heat Transfer**

Covers fundamentals of conduction, convection, and radiation; steady and unsteady heat conduction; fundamentals of boundary layer flows; introduction to forced and free convection for external and internal flows; blackbody radiation; and radiation and surface radiation properties.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: ENGR 210 Minimum Grade: D and (MEM 220 Minimum

Grade: D or CIVE 320 Minimum Grade: D ) and (MATH 210 Minimum

Grade: D or MATH 262 Minimum Grade: D or ENGR 232 Minimum

Grade: D )

Repeat Status: Not repeatable for credit

### **MEM 351 - Dynamic Systems Laboratory I**

Includes experiments involving modeling and simulation of linear and non-linear dynamic systems, including feedback controls. Spring.

Credits: 2.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 255 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 355 - Perf Enhancemt Dyn Systems**

This course introduces measures of performance of dynamical systems, means of computing/evaluation-of such measures, and how to design controllers to improve performance.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: MEM 255 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 361 - Engineering Reliability**

Reviews probability concepts and modeling of random phenomena, including parameter estimation, empirical determination of distribution models, catastrophic failure models, material strength and fatigue life distribution, and reliability improvement.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Junior

Senior

Pre-Requisites: MATH 290 Minimum Grade: D or MATH 201 Minimum

Grade: D or MATH 261 Minimum Grade: D or ENGR 231 Minimum

Grade: D

Repeat Status: Not repeatable for credit

**MEM 373 - Space Systems Engineering I**

Introduction to space engineering through presentation of two topics that serve as the foundation of space systems analysis and design: rocket propulsion and orbital mechanics.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: MEM 220 Minimum Grade: D and MEM 238 Minimum

Grade: D and MEM 310 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 374 - Space Systems Engineering II**

Introduction to design principles and theory of satellite systems engineering, including design theories and parameters involved in satellite development, as well as real life conditions such as applications, product assurance, assembly, and testing.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: MEM 373 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 380 - Special Topics Mech Engr**

Selected topics that meet student interests and faculty capabilities.

May be taken more than one time when the topics vary. Students may enroll in more than one section of this course in any one term when different topics are covered in each section. This is a writing intensive course.

Credits: 12.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Pre-Requisites:

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

**MEM 395 - Hess UG Scholars Research**

A change for undergraduates to experience independent research as part of the MEM Hess Honors Program. Weekly group meetings to discuss the details of the research endeavor are coupled with independent student in a research laboratory. May be repeated five times for credit.

Credits: .50 to 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: MEM 310 Minimum Grade: D

Repeat Status: Course can be repeated 5 time(s) for 18.00 credit(s)

**MEM 399 - Independ Study Mech Engr**

Provides independent study or research on a topic approved by the department.

Credits: .50 to 12.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Repeat Status: Course can be repeated 99 time(s) for 998.90 credit(s)

**MEM 400 - Internal Combustion Engines**

Covers engine types and trends, thermodynamics of engines and engine processes, ideal and actual engine processes and cycles, combustion and emissions, fuel chemistry and properties, detonation and knock, and engine testing and performance.

Credits: 3.00  
College: College of Engineering  
Department: Mechanical Engr & Mechanics  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: MEM 310 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **MEM 402 - Power Plant Design**

Covers heat cycle arrangement, equipment selection, analysis of cost demands, and diversity factors. Includes economic studies of plant and cycle arrangements.  
Credits: 3.00  
College: College of Engineering  
Department: Mechanical Engr & Mechanics  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: MEM 310 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **MEM 403 - Gas Turbines & Jet Propulsion**

Covers fundamentals of thermodynamics and aerothermodynamics, and application to propulsion engines; thermodynamic cycles and performance analysis of gas turbines and air-breathing propulsion systems, turbojet, turboprop, ducted fan, ramjet, and ducted rocket; theory and design of ramjets, liquid and solid rockets, air-augmented rockets, and hybrid rockets; aerodynamics of flames, including the thermodynamics and kinetics of combustion reactions; supersonic combustion technology and zero-g propulsion problems; and propulsion systems comparison and evaluation for space missions.  
Credits: 3.00  
College: College of Engineering  
Department: Mechanical Engr & Mechanics  
Restrictions:  
Must be enrolled in one of the following Program Level(s):  
Undergraduate Quarter  
Pre-Requisites: MEM 220 Minimum Grade: D and MEM 310 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **MEM 405 - Principles of Combustion I**

Covers thermochemistry, the relationship between heats of formation and bond energies, heat capacity and heats of reaction, chemical equilibrium, calculation of flame temperature, and composition of burned gas.  
Credits: 3.00  
College: College of Engineering  
Department: Mechanical Engr & Mechanics  
Restrictions:  
May not be enrolled in one of the following Program Level(s):

Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: MEM 410 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **MEM 406 - Principles of Combustion II**

Covers laminar flame propagation in premixed gases, detonation and deflagration, burning of liquid and solid fuels, and diffusion flames.  
Credits: 3.00  
College: College of Engineering  
Department: Mechanical Engr & Mechanics  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: MEM 405 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **MEM 410 - Thermodynamic Analysis II**

Covers thermodynamic analysis of ideal and real mixtures and gas phase reacting systems. Introduces equilibrium analysis.  
Credits: 3.00  
College: College of Engineering  
Department: Mechanical Engr & Mechanics  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: MEM 310 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **MEM 413 - HVAC Loads**

Human comfort and associated models; state-of-the-art methods of calculating building peak heating and cooling loads; analysis of different psychrometric processes; different types of secondary systems: description, operating principles, modeling, simulation and sizing of secondary systems.  
Credits: 3.00  
College: College of Engineering  
Department: Mechanical Engr & Mechanics  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
May not have the following Classification(s):  
Freshman  
Pre-Requisites: MEM 345 Minimum Grade: D and (MEM 310 Minimum Grade: D or AE 220 Minimum Grade: D )  
Repeat Status: Not repeatable for credit

#### **MEM 414 - HVAC Equipment**

Standard and real, single-stage multistage refrigeration cycles; vapor compression components (compressor, expansion devices, condensers, and evaporators); heat pumps; absorption systems; boilers; heat exchangers; cooling coils, cooling towers; part-load energy performance; annual energy; annual energy estimation methods (degree-day, bin method, modified degree-day).

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):  
Freshman

Pre-Requisites: MEM 345 Minimum Grade: D and (MEM 310 Minimum Grade: D or AE 220 Minimum Grade: D )

Repeat Status: Not repeatable for credit

### **MEM 415 - Fuel Cell Engines**

Introduces fundamental aspects and operating principles of fuel cell systems, including: basic electrochemical principles, thermodynamics required for understanding the operation, components including functions and materials, electrochemical performance characteristics, analysis of system losses and efficiency, various fuel cell types, current state of technology, application areas/implementation, and current technical challenges.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):  
Continuing Education

Pre-Requisites: (MEM 220 Minimum Grade: D or CHE 302 Minimum Grade: D or CHE 311 Minimum Grade: D or CIVE 320 Minimum Grade: D ) and MEM 310 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **MEM 417 - Introduction to Microfabrication**

This course focuses on the fundamentals of microfabrication technologies. The materials, principles, and applications of silicon-based microfabrication technologies such as photolithography, wet/dry etching, deposition techniques, surface micromachining, and polymer micromachining are covered. This course also includes two lab sessions through which students have hands-on experiences in microfabrication.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

Must be enrolled in one of the following Program Level(s):  
Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):  
Arts and Sciences

College of Engineering

Must have the following Classification(s):

Junior

Senior

Repeat Status: Not repeatable for credit

### **MEM 419 - Microfluidics and Lab-on-a-Chip**

This course focuses on design, manufacturing, and application of lab-on-a-chip systems as well as understanding microfluidic phenomena. The lecture covers novel microfluidic phenomena, microsensors, microactuators, and case studies. This course also includes two lab sessions through which student have hands-on experiences in lab-on-a-chip technology

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

Must be enrolled in one of the following Program Level(s):  
Undergraduate Quarter

Must be enrolled in one of the following College(s)/School(s):  
Arts and Sciences

College of Engineering

Must have the following Classification(s):

Junior

Senior

Pre-Requisites: MEM 417 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **MEM 420 - Aerodynamics**

Covers steady and unsteady flow, flow around a body, wing theory, thin airfoil theory, fundamental equation of finite-wing theory, and aerodynamic characteristics of wings. Introduces potential theory and boundary layer phenomena.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 220 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **MEM 423 - Mechanics of Vibration**

Covers free and forced vibrations of one-, two-, and multiple-degree-of-freedom systems; continuous systems; and transient and random vibration problems. Includes use of digital computer for homework and special class problems.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):  
Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 238 Minimum Grade: D and (TDEC 222 Minimum

Grade: D or ENGR 232 Minimum Grade: D or MATH 210 Minimum

Grade: D or MATH 262 Minimum Grade: D )

Repeat Status: Not repeatable for credit



**MEM 424 - Biomechanics**

Introduces modeling of dynamics of biomechanical systems.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 202 Minimum Grade: D and MEM 238 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 425 - Aircraft Design & Perform**

Introduces aerodynamics and airfoils; steady flight; power required and power available curves; range and endurance; takeoff, glide, and landing; stick force and control-free stability; moment coefficients and derivatives; and designing to specification. Students must have Junior class standing.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Junior

Senior

Repeat Status: Not repeatable for credit

**MEM 426 - Aerospace Structures**

Covers properties of wing and fuselage sections, torsion of thin-walled and skin-stringer multiple-cell sections, non-symmetrical bending of wing and fuselage sections, shear in thin-walled and skin-stringer sections, and buckling. Introduces matrix methods.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 230 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 427 - Finite Element Methods**

Introduces the fundamental theory and formulations of finite element method and its application in structural mechanics and thermal/fluid science. Topics include formulation of 1-D and 2-D elements, isoparametric elements, static and dynamic analysis of trusses, beams, and frames, 2-D plane problems, and heat transfer problems.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: MEM 230 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 428 - Introduction to Composites I**

Introduces anisotropic elasticity, lamina stiffness and compliance, plane stress and strain, test methods, and failure criteria.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 330 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 429 - Introduction to Composites II**

Covers laminated plate theory, stiffness and compliance of laminated plates, effect of laminated configuration on elastic performance, and strength production.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 428 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 430 - Advanced Stress Analysis**

Examines three-dimensional representation of stress and strain, coordinate transformation, stress strain relationships for anisotropic and isotropic materials, equilibrium equations, boundary value problems, governing equations in plane strain and plane stress problems, Airy's stress function, two-dimensional problems in polar coordinates, and selected applications to stress analysis problems in mechanical engineering.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 330 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 431 - Machine Design I**

Covers static strength and fatigue theories of failure, fasteners, welded joints, springs, roller bearings, and lubricated spur gears.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Junior

Pre-Junior

Sophomore

Pre-Requisites: MEM 202 Minimum Grade: D and MEM 230 Minimum

Grade: D and MEM 238 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 435 - Intro Comp Aid Design/Mfg**

Covers fundamental use of CAD/CAM systems for geometry definition, finite element applications, and introductory computer graphics concepts.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Junior

Senior

Pre-Requisites: MEM 201 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 436 - Intro To Comp-Aided Mfg**

Examination of the basic elements that are used to integrate the design and manufacturing processes. Robotics computerized-numerical controlled machine, and CAD/CAM systems. Manufacturability considerations when integrating unit process elements.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 201 Minimum Grade: D and MEM 435 Minimum

Grade: D

Repeat Status: Not repeatable for credit

**MEM 437 - Manufacturing Process I**

Examines the basic elements used to integrate the design and manufacturing processes; robotics, computerized-numerical-controlled

machines, and CAD/CAM systems; and manufacturability considerations when integrating unit process elements.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 220 Minimum Grade: D and MEM 230 Minimum

Grade: D

Repeat Status: Not repeatable for credit

**MEM 438 - Manufacturing Process II**

Covers plastics and reinforced plastics processes, theory of polymer and plastic process, simple models of polymer flows, and manufacturability of plastics.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 437 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 440 - Thermal Systems Analysis**

This course covers fundamentals of thermal systems; the role of design in engineering practice; economic analysis of thermal systems; advanced concepts and analysis of heat exchangers and distillation equipment; modeling of thermal systems; simulation of thermal systems; fundamentals of optimization and design of optimized thermal systems.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 345 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 444 - Biofluid Mechanics**

This course introduces flow-related anatomy and pathophysiology, and biomedical flow devices and their design challenges. Analysis methods to solve biological fluid mechanics design problems are introduced and several interdisciplinary team projects are assigned to apply fluid mechanics to practical biological or medical problems.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: MEM 220 Minimum Grade: D or BMES 451 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MEM 446 - Fundamentals of Plasmas I**

Introduces the fundamentals of plasma science and modern industrial plasma applications in electronics, fuel conversion, environmental control, chemistry, biology, and medicine. Topics include quasi-equilibrium and non-equilibrium thermodynamics, statistics, fluid dynamics and kinetics of plasma and other modern high temperature and high energy systems and processes.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: PHYS 201 Minimum Grade: D or TDEC 201 Minimum Grade: D or PHYS 112 Minimum Grade: D or PHYS 187 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MEM 447 - Fundamentals of Plasmas II**

Continues the development of the engineering fundamentals of plasma discharges applied in modern industrial plasma applications in electronics, fuel conversion, environmental control, chemistry, biology, and medicine. Topics include quasi-equilibrium and non-equilibrium thermodynamics, statistics, fluid dynamics of major thermal and non-thermal plasma discharges, operating at low, moderate and atmospheric pressures.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: MEM 446 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MEM 448 - Applications of Thermal Plasmas**

Introduces applications of modern thermal plasma processes focused on synthesis of new materials, material treatment, fuel conversion, environmental control, chemistry, biology, and medicine. Topics include thermodynamics and fluid dynamics of high temperature plasma processes, engineering organization of specific modern thermal plasma technologies.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: PHYS 201 Minimum Grade: D or TDEC 201 Minimum Grade: D or PHYS 112 Minimum Grade: D or PHYS 187 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MEM 449 - Applications of Non-Thermal Plasmas**

Application of modern non-thermal plasma processes focused on synthesis of new materials, material treatment, fuel conversion, environmental control, chemistry, biology, and medicine. Topics include non-equilibrium thermodynamics and fluid dynamics of cold temperature plasma processes, engineering organization of specific modern non-thermal plasma technologies.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: PHYS 201 Minimum Grade: D or TDEC 201 Minimum Grade: D or PHYS 112 Minimum Grade: D or PHYS 187 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MEM 453 - Aircraft Flight Dynam & Ctrl I**

Covers general equations of motion for aircraft; linearization based on small disturbance theory and modal analysis to identify longitudinal open-loop characteristics; review of classical control theory; state space analysis; and autopilot design, including classical, pole placement, and optimal.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 355 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MEM 454 - Aircraft Flight Dynam& Ctrl II**

Covers observers; lateral dynamics; Dutch roll, roll convergence, and spiral modes; autopilot design and evaluations; and inertial cross-coupling computer simulation and analysis.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 453 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 455 - Introduction to Robotics**

Introduces basic concepts in robot operation and structure, including actuators, sensors, mechanical components, robot control and robot programming.

Credits: 4.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 238 Minimum Grade: D and MEM 255 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 456 - Robotics II**

Covers homogeneous kinematics of robots; velocities and accelerations; and static forces in manipulators, including iterative Newton-Euler formulation of manipulator dynamics.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 455 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 457 - Robotics III**

Covers robotic-based automated manufacturing, including robot work cell configurations, applications of robots in manufacturing, material transfer, assembly, and inspection.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must be enrolled in one of the following College(s)/School(s):

College of Engineering

Must have the following Classification(s):

Senior

Pre-Requisites: MEM 456 Minimum Grade: D

Repeat Status:

**MEM 458 - Micro-Based Control Sys I**

Provides hands-on experience in real-time control and manipulation of hardware dynamic systems, including microcomputer, architecture, software, and device drivers. Emphasizes real-time interfacing of data acquisition and control systems.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 355 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 459 - Micro-Based Control Sys II**

Continues MEM 458. Provides real-time control and manipulation of hardware dynamic systems. Emphasizes real-time interfacing of data acquisition and control systems.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

May not have the following Classification(s):

Freshman

Pre-Requisites: MEM 458 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 462 - Intro To Engr Mgmt**

Introduces the general theory of management, including the processes of planning, organizing, assembling resources, supervising, and controlling. This is a writing intensive course.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Junior

Senior

Repeat Status: Not repeatable for credit

**MEM 475 - Medical Robotics I**

Use of robots in surgery, safety considerations, understanding robot kinematics, analysis of surgeon performance using a robotic devices, inverse kinematics, velocity analysis, acceleration analysis, various types of surgeries case study.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: MEM 238 Minimum Grade: D

Repeat Status: Not repeatable for credit

**MEM 476 - Medical Robotics II**

Force and movement for robot arms, robot dynamics, computer vision, vision based control, combining haptics, vision and robot dynamics in a cohesive framework for the development of a medical robotic system.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: MEM 475 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MEM 477 - Haptics for Medical Robotics**

Introduction to haptics, physiology of touch, actuators, sensors, non-portable force feedback, portable voice feedback, tactile feedback interfaces, haptic sensing and control.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Pre-Requisites: MEM 238 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MEM 478 - Computer-Aided Tissue Engr**

Introduction to the engineering aspects of tissue reengineering and integrated CAD/CAE/CAM technology applied to tissue engineering with hands-on experience combining CAD, medical image processing, 3-D reconstruction software, and solid freeform fabrication of tissue scaffolding.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

Must be enrolled in one of the following Program Level(s):

Undergraduate Quarter

Must have the following Classification(s):

Senior

Repeat Status: Not repeatable for credit

#### **MEM 491 - Senior Design Project I**

Introduces the design process, including information retrieval, problem definition, proposal writing, patents, and design notebooks. Includes presentations on problem areas by experts from industry, government, and education.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: MEM 230 Minimum Grade: D and MEM 238 Minimum Grade: D and MEM 355 Minimum Grade: D and MEM 345 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MEM 492 - Senior Design Project II**

Continues MEM 491. Requires written and oral progress reports.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: MEM 491 Minimum Grade: D

Repeat Status: Not repeatable for credit

#### **MEM 493 - Senior Design Project III**

Continues MEM 492. Requires written and oral final reports, including oral presentations by each design team at a formal Design Conference open to the public and conducted in the style of a professional conference.

Credits: 3.00

College: College of Engineering

Department: Mechanical Engr & Mechanics

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Must have the following Classification(s):

Senior

Pre-Requisites: MEM 492 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **Software Engineering Courses**

#### **SE 101 - Foundations of Software Engineering I**

Teaches students basic programming concepts within a software engineering process that involves specification, documentation, and testing. Programming coverage includes basic programming concepts such as the declaration and assignment of variables, standard data types, constants, conditional statements, loops, introduction to classes and methods, standard and file input/output, arrays, and strings.

Process concepts emphasize good internal documentation practices, specifying functional requirements, defect tracking and analysis, and "black-box" testing.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Co-Requisites: EXAM 080

Repeat Status: Not repeatable for credit

### **SE 102 - Foundations of Software Engineering II**

Introduces students to additional programming concepts. Teaches students how to design, implement, and test object-oriented software applications using simple reusable components. Introduces basic techniques for creating reusable software components. Provides an overview of the software engineering as a discipline.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Co-Requisites: EXAM 080

Pre-Requisites: SE 101 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **SE 103 - Foundations of Software Engineering III**

Introduces students to issues and practices for working with medium-size software systems. Teaches students basic techniques for using application frameworks. Introduces students to software development in teams and provides an overview of the software engineering professional practice.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: SE 102 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **SE 210 - Software Specification and Design I**

Study of the principles, practices, and techniques used to gather system requirements and document them in a requirements specification. Includes techniques for requirements discovery such as user interviews and prototyping. Introduces approaches for organizing and expressing software requirements in a requirements specification.

Credits: 3.00

College: Information Sci & Technology

Department: College of Info Science & Tech

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: SE 103 Minimum Grade: D or CS 133 Minimum Grade: D or CS 172 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **SE 211 - Software Specification and Design II**

Continues study of requirements with increasing emphasis on converting requirements into a software system design. Presents alternate approaches, techniques for evaluating specifications, specification and design tools, and use of specifications to develop system-level tests.

Credits: 3.00

College: Information Sci & Technology

Department: College of Info Science & Tech

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: SE 210 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **SE 280 - Spec Topics in Software Engr**

This course covers topics in software engineering. Different topics may be considered in different quarters.

Credits: 4.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Repeat Status: Course can be repeated 98 time(s) for 998.00 credit(s)

### **SE 310 - Software Architecture I**

Study of macro-level software system architectures with an emphasis on approaches to interconnection and distribution of current and emerging architectural styles.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: SE 211 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **SE 311 - Software Architecture II**

Continues discussion of software architecture with a focus on micro-level architecture including patterns, frameworks, and component-based software engineering, and commercial off-the-shelf software.

Credits: 3.00

College: College of Engineering

Department: Computer Science

Restrictions:

May not be enrolled in one of the following Program Level(s):

Continuing Education

Pre-Requisites: SE 310 Minimum Grade: D

Repeat Status: Not repeatable for credit

### **SE 320 - Software Verification and Validation**

Presents theory and practice of software testing. Covers structural testing including such topics as path testing, dataflow testing, logic based testing, syntax testing, program slicing, mutation testing, fault injection, program perturbation, and testing tools. Discusses techniques for test construction and test suite evaluation, and validation against requirements and design models. Also covers methods of inspection and review at various phases of the software lifecycle.

Credits: 3.00

College: College of Engineering  
Department: Computer Science  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Pre-Requisites: CS 260 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **SE 410 - Software Evolution**

Covers issues related to change in software systems. Addresses principles and techniques of corrective software maintenance, software enhancements, and software product family. Introduces students to issues of change in large software systems including configuration control, change and product management.  
Credits: 3.00  
College: Information Sci & Technology  
Department: College of Info Science & Tech  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Pre-Requisites: CS 260 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **SE 480 - Adv Topics in Software Engr**

This course covers topics in Software Engineering selected from advanced topics from research in this field. Different topics may be considered in different quarters.  
Credits: 4.00  
College: College of Engineering  
Department: Computer Science  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Repeat Status: Course can be repeated 98 time(s) for 998.99 credit(s)

#### **SE 491 - Design Project I**

An independent project in which student teams design and implement a software system under faculty guidance. Students apply a defined software engineering process for the project including process customization as appropriate.  
Credits: 3.00  
College: Information Sci & Technology  
Department: College of Info Science & Tech  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Must have the following Classification(s):  
Senior  
Repeat Status: Not repeatable for credit

#### **SE 492 - Design Project II**

Continues Design Project I.  
Credits: 3.00  
College: Information Sci & Technology

Department: College of Info Science & Tech  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Must have the following Classification(s):  
Senior  
Pre-Requisites: SE 491 Minimum Grade: D  
Repeat Status: Not repeatable for credit

#### **SE 493 - Design Project III**

Continues Design Project II.  
Credits: 3.00  
College: Information Sci & Technology  
Department: College of Info Science & Tech  
Restrictions:  
May not be enrolled in one of the following Program Level(s):  
Continuing Education  
Must have the following Classification(s):  
Senior  
Pre-Requisites: SE 492 Minimum Grade: D  
Repeat Status: Not repeatable for credit