Dean Satish Udpa  
College of Engineering  

Re: Final report of EGR items processed on UCC  

May 9, 2012  

A summary of this activity is below, with the details following on subsequent pages (deleted text is gray). Some text is in red, which represents last-minute adjustments that were approved at UCC. The attached pages are an extract of agenda items processed through the University Curriculum Committee; all were approved.  

Minor program changes (housekeeping) to ME program  
Significant program changes to MSE program  
Establishment of a MSE minor  

8 new courses introduced (5 related to MSE curriculum revision)  
(MSE 410, MSE810, MSE841, MSE 260, MSE 460, CE 838, ENE490, ENE 492)  
32 courses changed (10 related to MSE curriculum revision)  
2 deleted course (CHE 101, EGR 110)  

Sincerely,  

Thomas R Bieler  
Professor, Chemical Engineering and Materials Science  
Email: bieler@egr.msu.edu  517 353-9767  

cc: Pam Cosner, Jamie Ramos, Tom Wolff, Rich Enbody
September 15, 2011

MSE 410 Materials Foundations for Energy Applications
Spring of every year. 3(3-0) RB: MSE 310 or ME 201 or CHE 321 R: Open to seniors in the
Department of Chemical Engineering and Materials Science.
NEW Role of materials to enable new energy generation, storage, and distribution technologies;
thermoelectric materials, electrochemistry of batteries, semiconductors for solar cells,
radiation tolerant materials, processing of biobased fuels, greenhouse gas mitigation
approaches
Effective Spring 2012

MSE 810 Materials for Energy Applications
Spring of every year. 3(3-0) RB: ME 802 or MSE 851 or CHE 821 R: Open to graduate students in
the Department of Chemical Engineering and Materials Science. Not open to students with credit in
MSE 410.
NEW Role of materials to enable new energy generation, storage, and distribution technologies;
thermoelectric materials, electrochemistry of batteries, semiconductors for solar cells,
radiation tolerant materials, processing of biobased fuels, greenhouse gas mitigation
approaches
Effective Spring 2012

MSE 841 Advanced Spectroscopy and Diffraction Analysis of Materials
Fall of every year. 3(2-3) RB: PHY 184 or PHY 184B or PHY 234B R: Open to graduate students in
the College of Engineering.
NEW General properties, generation, and detection of x-ray interaction with solids.
Crystallography, reciprocal space, diffraction analysis, and techniques. Single crystal
Effective Fall 2011

November 10, 2011

1. Request to change the requirements in the Bachelor of Science degree in Mechanical Engineering in the
Department of Mechanical.
The concentrations in the Bachelor of Science degree in Mechanical Engineering are noted on the student’s
academic record when the requirements for the degree have been completed.
a. Under the heading Requirements for the Bachelor of Science Degree in Mechanical
Engineering make the following changes:
(1) In item 3. b. make the following changes:
(a) Change the total credits from ‘42’ to ‘41’.
(b) Delete the following course:
ME 180 Engineering Graphic Communications 3
Add the following course:
ME 280 Graphic Communications 2
(2) In item 3. c. Senior Electives delete the following courses:
ME 432 Intermediate Fluid Mechanics 3
ME 457 Mechatronic System Modeling and Simulation 3
ME 486 International Networked Teams for Engineering
Design 3
(3) Under the heading Concentration in Biomechanical Engineering make the following
changes:
(a) Delete the following course:
BS 111 Cells and Molecules 3
Add the following course:
BS 161 Cell and Molecular Biology 3
(b) Add the following statement:
Students must obtain department approval prior to enrollment in ME 490 or 491.
Effective Summer 2012.
ME 285 Computer Aided Design Tools
Fall of every year. Spring of every year. 3(0-6) P: (ME 180) P: ME 280 R: Open only to students in the Mechanical Engineering major. R: Open only to students in the College of Engineering.
Advanced 3-D solid modeling. CNC programming, and rapid prototyping. Advanced 3-D solid modeling.
SA: MSM 260
Effective Fall 2005 Effective Fall 2011

ME 456 Mechatronic System Design
Fall of every year. 3(2-3) P: (ECE 345 and ME 451 or concurrently) P: (ECE 345 or concurrently) and (ME 391 or concurrently) R: Open only to juniors or seniors in the Mechanical Engineering major. R: Open to juniors or seniors in the Department of Mechanical Engineering.
Application of embedded microcontrollers to the design of mechatronic systems. Design of software and hardware for systems with mechanical, electrical and fluid components plus embedded control systems. Laboratory exercises and design projects. Application to automotive, consumer and commercial systems. Application of embedded microcontrollers to the design of mechatronic systems. Introduction to feedback and feedforward control concepts. Design of software and hardware for systems with mechanical, electrical and fluid components plus embedded control systems. Laboratory exercises and design projects. Application to automotive, consumer, industrial, and commercial systems.
Effective Summer 2002 Effective Fall 2011

ME 475 Computer Aided Design of Structures
Fall of every year. Spring of every year. Summer of every year. 3(2-2) 3(3-0) P: (ME 471 or concurrently) P: ME 471 or concurrently R: Open only to seniors in the Mechanical Engineering major. R: Open to seniors in the Mechanical Engineering major.
Computational methods for analysis, design, and optimization of structural components. Basic concepts in geometric modeling, finite element analysis, and structural optimization.
Effective Fall 2003 Effective Fall 2011

ME 497 Biomechanical Design
Biomechanical Design in Product Development
Spring of every year. 3(3-0) Interdepartmental with Biomedical Engineering. P: ME 371 or concurrently R: Open only to juniors or seniors in the College of Engineering, R: Open to juniors or seniors in the Department of Mechanical Engineering.
Biomechanical product design with application to people or animals. Synthesis, prototyping, and analysis of designs. Project management. Market research.
SA: BME 491A, MSM 445
Effective Fall 2002 Effective Summer 2012

January 19, 2012

EGR 100 Introduction to Engineering Design
Fall of every year. Spring of every year. 2(1-2) P: (MTH 116 or concurrently) or (MTH 132 or concurrently) or (MTH 152H or concurrently) or (LBS 118 or concurrently) P: (MTH 116 or concurrently) or (MTH 132 or concurrently) or (MTH 152H or concurrently) or (LBS 118 or concurrently)) and (WRA 1004 or designated score on English Placement test ) R: Open to freshmen or sophomores in the College of Engineering and open to students in the Lyman Briggs School. R: Open to students in the College of Engineering and open to students in the Lyman Briggs College.
Engineering design process as modeled by team-based, interdisciplinary design projects. Roles of engineers and the contributions of engineering in society. Project management, and design of products and processes to specified outcomes under specified constraints. Introduction to computing tools and physical equipment in support of engineering design. Engineering ethics. Engineering design process as modeled by team-based, interdisciplinary design projects. Roles of engineers and the contributions of engineering in society. Project management, and design of products and processes to specified outcomes under specified constraints. Introduction to computing tools and physical equipment in support of engineering design. Engineering ethics. Oral and written technical communications.
Effective Fall 2007 Effective Summer 2012

UCC Engineering summary 5/9/2012
CHE 101 Molecular Frontiers in Chemical Engineering
Fall of every year. 1(2-0) RB: High school chemistry, biology, algebra, physics.
Influence of chemical engineering on society. History of the profession and future
directions. Career opportunities in chemical engineering. Hands-on illustrations of
chemical engineering principles. Problem solving skills and development of creativity.
Computers and computations in chemical engineering. Development of written and oral
communication skills.
DELETE COURSE
Effective Fall 2011

CHE 210 Modeling and Analysis of Transport Phenomena
Fall of every year. Spring of every year. 3(3-0) P: (MTH 235 or concurrently) and ((CSE 131 or
concurrently) or (EGR 102 or concurrently) or (CSE 231 or concurrently)) and CHE 201 P: (MTH
235 or concurrently) and CHE 201
Steady and unsteady state material and energy balances. Fluxes and rate processes.
Shell balances. Balance equations for mass, heat, and momentum transport. Analogies
among mass, heat, and momentum transport. Analytical and numerical solutions.
Application of computational methods to problem solutions.
Effective Spring 2009 Effective Spring 2012

CHE 301 Chemical Engineering as a Profession
Fall of every year. 1(2-0) P: CHE 201 P: CHE 201 or concurrently RB: Junior standing in chemical
engineering R: Open to students in the Chemical Engineering major.
Professional aspects of chemical engineering. Communication skills, professionalism and
ethics, teamwork skills, contemporary engineering issues, career planning, project
management, and industrial processes.
Effective Fall 2007 Effective Spring 2012

CHE 316 Laboratory Practice and Statistical Analysis
Spring of every year. Summer of every year. 4(2-6) P: (CHE 311 and (CHE 312 or concurrently)
and (CHE 321 or concurrently) and (CHE 431 or concurrently)) and completion of Tier I writing
requirement P: Open only to students in the Department of Chemical Engineering and Materials
Science R: Open to students in the College of Engineering or in the Department of Chemical
Engineering and Materials Science or in the College of Engineering.
Practical experience with unit operations equipment, including separations processes,
reactor systems, and chemical processes requiring analysis of heat, mass and momentum
transport. Laboratory assignments requiring teamwork. Engineering statistics with focus
on model building, experimental design, and statistical quality control.
Effective Summer 2005 Effective Spring 2012

CHE 481 Biochemical Engineering
Fall of every year. 3(2-3) P: (CHE 431 and BMB 401) or (BMB 461 and BMB 462) P: (BMB 401 or
(BMB 461 and BMB 462)) and CHE 431
Applications of microbiology and biochemistry to biochemical engineering. Kinetics and
thermodynamics of biochemical reactors. Transport phenomena in biological systems.
Bioreactor design and scale-up.
Effective Fall 2007 Effective Spring 2012

ME 201 Thermodynamics
Fall of every year. Spring of every year. 3(3-0) P: (CEM 141 or CEM 151 or CEM 181H or LBS 171)
and ((MTH 234 or concurrently) or (MTH 254H or concurrently) or (LBS 220 or concurrently)) and
PHY 183 P: (CEM 141 or CEM 151 or CEM 181H or LB 171) and ((MTH 234 or concurrently) or
(MTH 254H or concurrently)) and (PHY 183 or PHY 183B or PHY 193H or LB 273) Not open to
students with credit in CHE 321 or BE 351 or MSE 351. Not open to students with credit in BE 351
or CHE 321.
Basic concepts of thermodynamics. Property evaluation of ideal gases and compressible
substances. Theory and application of the first and second laws of thermodynamics.
Entropy and Carnot efficiency. Basic concepts of thermodynamics. Thermodynamic
properties and their evaluation. Theory and application of conservation of mass and the
first and second laws of thermodynamics. Carnot efficiency and cyclic processes for
power generation and refrigeration.
ME 461 Mechanical Vibrations
Fall of every year. Spring of every year. 4(3-3) 3(3-0) P: ME 361 and ME 391 R: Open to juniors or seniors in the Mechanical Engineering major.
Modeling and analysis of oscillatory phenomena found in linear discrete and continuous mechanical systems.
Effective Summer 2010 Effective Fall 2012

February 16, 2012

EGR 110 ROSES Engineering Seminar
Fall of every year. 1(2-0) R: Open to freshmen in Residential Option for Science and Engineering.
Seminar for ROSES students. Transition issues, success issues, and the exploration of engineering as a major and profession.
DELETE COURSE
Effective Summer 2012

April 17, 2012

1. Request to change the requirements in the Bachelor of Science degree in Materials Science and Engineering in the Department of Chemical Engineering and Materials Science. The concentrations in the Bachelor of Science degree in Materials Science and Engineering are noted on the student's academic record when the requirements for the degree have been completed.
   a. Under the heading Requirements for the Bachelor of Science Degree in Materials Science and Engineering make the following changes:
      (1) In item 3. a. make the following changes:
         (a) Change the total credits from '41' to '44' to '42'.
      PART I - NEW ACADEMIC PROGRAMS AND PROGRAM CHANGES – continued - 2
      April 17, 2012
      (b) Delete the following courses:
         MSE 331 Materials Characterization Methods I
         MSE 350 Electronic Structure and Properties of Materials 3
         MSE 477 Manufacturing Processes 3
      Add the following courses:
         MSE 260 Electronic, Magnetic, Thermal and Optical Properties of Materials 3
         MSE 331 Materials Characterization Methods I 2
      (2) Change item 3. b. to the following:
         Four of the following courses (12 credits):
         ME 477 Manufacturing Processes 3
         MSE 454 Ceramic and Refractory Materials 3
         MSE 460 Electronic Structure and Bonding in Materials and Devices 3
         MSE 465 Design and Application of Engineering Materials 3
         MSE 476 Physical Metallurgy of Ferrous and Aluminum Alloys 3
      (3) Change item 3. c. from '5' credits to '6' credits.
      (4) Change item 3. d. from '7' credits to '3' credits.
      (5) Under the heading Biomedical Materials Engineering make the following changes:
         (a) Change the total credits from '25' to '28'.
         (b) Change item 2. to "Two of the following courses (5 credits)" and add the following courses:
         ME 477 Manufacturing Processes 3
         MSE 460 Electronic Structure and Bonding in Materials and Devices 3
      (6) Under the heading Manufacturing Engineering make the following changes:
         (a) Change the total credits from '18' to '21'.
         (b) In item 1. add the following course:
ME 477 Manufacturing Processes 3
(7) Under the heading **Metallurgical Engineering** make the following changes:
(a) Change the total credits from ‘18’ to ‘21’
(b) Change item 1. to the following:
   All of the following courses (18 credits):
   ME 423 Intermediate Mechanics of Deformable Solids 3
   ME 475 Computer Aided Design of Structures 3
   ME 477 Manufacturing Processes 3
   MSE 451 Spectroscopic and Diffraction Analysis of Materials 3
   MSE 465 Design and Application of Engineering Materials 3

PART I - NEW ACADEMIC PROGRAMS AND PROGRAM CHANGES – continued - 3
April 17, 2012
MSE 476 Physical Metallurgy of Ferrous and Aluminum Alloys 3
(c) In item 2. delete the following course:
   MSE 451 Microscopic and Diffraction Analysis of Materials 3
   Add the following course:
   MSE 426 Introduction to Composite Materials 3
(8) Under the heading **Polymeric Engineering** make the following changes:
(a) Change the total credits from ‘15’ to ‘21’.
(b) Number the current list of courses to Item 1.
(c) In item 1. change the credits from ‘15’ to ‘18’ and add the following course:
   MSE 460 Electronic Structure and Bonding in Materials and Devices 3
(d) Add the following item 2.:
   Complete at least 3 credits in courses selected from a list of approved technical electives available from the Department of Chemical Engineering and Materials Science.
   Effective Fall 2012.

2. Request to establish a **Minor in Materials Science and Engineering** in the Department of Chemical Engineering and Materials Science. The University Committee on Undergraduate Studies (UCUS) recommended approval of this request at its February 23, 2012 meeting.

a. **Background Information**: Materials have become an important issue across all fields of engineering. Students in mechanical engineering, electrical engineering, and other majors are expressing interest in obtaining a more detailed education in materials science.

b. **Academic Programs Catalog Text**: The Minor in Materials Science and Engineering, which is administered by the Department of Chemical Engineering and Materials Science, provides students with a basic foundation in materials science that is applicable to many disciplines. The minor also offers opportunities for students to work in industry, research, or government, as well as to prepare for graduate study in materials science. The minor is available as an elective to students in a bachelor’s degree program in the College of Engineering, other than the Bachelor of Science Degree in Materials Science and Engineering. With the approval of the college, the courses that are used to satisfy the minor may also be used to satisfy the requirements for the bachelor’s degree. At least 12 unique credits counted towards the requirements for a student’s minor must not be used to fulfill the requirements for that student’s major.

Students who plan to complete the requirements for the minor must apply to the Department of Chemical Engineering and Materials Science. To be accepted into the minor, the student must be admitted into the College of Engineering. Enrollment for some MSE courses may be limited.

Application forms are available at [www.chems.msu.edu](http://www.chems.msu.edu).

PART I - NEW ACADEMIC PROGRAMS AND PROGRAM CHANGES – continued - 4
April 17, 2012

**Requirements for the Minor in Materials Science and Engineering**

**CREDITS**
Complete 18 credits from the following:
1. Both of the following courses (6 credits):
   MSE 250 Materials Science and Engineering 3
   MSE 360 Fundamentals of Microstructural Design 3
2. One of the following courses (3 credits):
   MSE 260 Electronic, Magnetic, Thermal and Optical Properties of Materials 3
   MSE 310 Phase Equilibria in Materials 3
   MSE 320 Mechanical Properties of Materials 3
   MSE 370 Synthesis and Processing of Materials 3
3. Three of the following courses (9 credits):
   MSE 310 Phase Equilibria in Materials 3
   MSE 320 Mechanical Properties of Materials 3
   MSE 370 Synthesis and Processing of Materials 3
   MSE 410 Materials Foundations for Energy Applications 3
   MSE 425 Biomaterials and Biocompatibility 3
   MSE 451 Spectroscopic and Diffraction Analysis of Materials 3
   MSE 454 Ceramic and Refractory Materials 3
   MSE 460 Electronic Structure and Bonding in Materials and Devices 3
   MSE 465 Design and Application of Engineering Materials 3
   MSE 466 Design & Failure Analysis (W) 3
   MSE 476 Physical Metallurgy of Ferrous and Aluminum Alloys 3
   MSE 477 Manufacturing Processes 3

A course used to fulfill requirement 2. above may not be used to fulfill this requirement.

Effective Fall 2012.

CSE 131 Technical Computing and Problem Solving
Fall of every year. Spring of every year. 3(1-3) P: (MTH 124 or concurrently) or (MTH 132 or concurrently) or (LBS 118 or concurrently)
Use of computing systems for technical problem solving in engineering and science.
SA: CPS 131
Effective Fall 2004 Effective Summer 2012

CSE 201 Fundamentals of Information Technology
Fall of every year. Spring of every year. 3(3-0) P: (CSE 101 or CSE 131) and (MTH 103 or MTH 116 or MTH 124 or MTH 132 or LBS 117) P: (CSE 101 or CSE 131) and (MTH 103 or MTH 116 or MTH 124 or MTH 132 or LB 118) RB: high school algebra; literacy in web and computer tools, such as editor and browser.
Digital representation of objects such as numbers, signals, and 3-dimensional shapes.
Algorithms that operate on digital objects. Computer communications and the Internet.
Computer security and web services.
SA: CSE 240
Effective Fall 2007 Effective Summer 2012

CSE 231 Introduction to Programming I
Fall of every year. Spring of every year. Summer of every year. 4(3-2) P: (LBS 118 or concurrently) or (MTH 124 or concurrently) or (MTH 132 or concurrently) or (MTH 152H or concurrently) P: (LB 118 or concurrently) or (MTH 124 or concurrently) or (MTH 132 or concurrently) or (MTH 152H or concurrently)
Introduction to programming using Python. Design, implementation and testing of programs to solve problems such as those in engineering, mathematics and science.
Programming fundamentals, functions, objects, and use of libraries of functions.
SA: CSE 230
Effective Fall 2007 Effective Summer 2012

CSE 232 Introduction to Programming II
Fall of every year. Spring of every year. 4(3-2) P: CSE 231 and (LBS 118 or MTH 124 or MTH 132 or MTH 152H) P: CSE 231 and (LB 118 or MTH 124 or MTH 132 or MTH 152H)
Continuation of object-centered design and implementation in C++. Building programs from modules. Data abstraction and classes to implement abstract data types. Static and
SA: CSE 330
Effective Spring 2007 Effective Summer 2012

CSE 260 Discrete Structures in Computer Science
Fall of every year. Spring of every year. 4(4-0) P: MTH 133 or MTH 126 or MTH 153H or LIB 119
P: MTH 133 or MTH 126 or MTH 153H or LB 119
Set operations, relations, functions. Grammars and finite state automata. Discrete
probability. Applications to computer science and engineering.
SA: CPS 260
Effective Fall 2004 Effective Summer 2012

MSE 260 Electronic, Magnetic, Thermal and Optical Properties of Materials
Spring of every year. 3(3-0) P: MSE 250 and (PHY 184 or concurrently) Not open to students with
credit in MSE 350.
NEW Processing, structures, and properties of ceramics, polymers, and composites. Electrical,
thermal, magnetic and optical properties of materials. Materials selection and design.
Effective Fall 2012

MSE 310 Phase Equilibria in Materials
Fall of every year. 3(3-0) P: (MSE 250 or concurrently) and (MSE 331 or concurrently) and (MTH
234 or MTH 254H or LB 220) P: (MSE 250 or concurrently) and ((MTH 234 or concurrently) or
(MTH 254H or concurrently) or (LB 220 or concurrently)) R: Open to juniors or seniors in the
College of Engineering.
Enthalpy. Entropy. Free energy. Phase changes in metal, ceramic, and polymer
materials systems. Application to alloying, phase diagram determination, and
electrochemistry.
SA: MSE 351
Effective Fall 2010 Effective Fall 2012

MSE 320 Mechanical Properties of Materials
Fall of every year. 3(3-0) P: (ME 222 or concurrently) and MSE 250 R: Open to juniors or
seniors in the Materials Science and Engineering major R: Open to juniors or seniors in the
Materials Science and Engineering major or approval of department.
Mechanical behavior of metals, ceramics, and polymers. Three-dimensional stress-states.
Stress, strain, and compliance tensors. Test methods. Elastic, viscoelastic, and plastic
deforination. Fracture, fatigue, and creep.
SA: MSE 355
Effective Fall 2010 Effective Fall 2012

MSE 331 Materials Characterization Methods I
Fall of every year. 1(0-3) 2(1-3) P: MSE 309 or concurrently R: Open to juniors or seniors in the
Materials Science and Engineering major. C: MSE 310 concurrently.
Thermal analysis. Optical and Scanning Electron Microscopy Laboratory for characterizing
microstructure-property relationships. Effects of processing on microstructures, properties,
and fracture surfaces in metal, ceramic and polymer systems.
SA: MSE 375
Effective Summer 2006 Effective Fall 2012

MSE 360 Fundamentals of Microstructural Design
Spring of every year. 3(3-0) P: MSE 310 and (MSE 350 or concurrently) P: MSE 310 or CHE 321 or
PHY 215 RB: ((MTH 235 or concurrently) or (MTH 255H or concurrently)) and (MSE 260 or
concurrently) R: Open to juniors or seniors in the College of Engineering. R: Open to juniors
or seniors in the Department of Chemical Engineering and Materials Science or approval of
department.
energy storage from solidification, phase changes, and deformation to predict
and control microstructural changes and stability during processing in metal, ceramic, and
polymer systems.
SA: MSE 352
MSE 370 Physical Processing of Materials
Synthesis and Processing of Materials
Spring of every year. 3(3-0) P: MSE 310 or CHE 321 P: ME 201 or PHY 215 or MSE 310 or CHE 321 RB: MSE 250 and (MSE 350 or concurrently) RB: MSE 250 and (MSE 260 or concurrently) R: Open to students in the Department of Chemical Engineering and Materials Science. R: Open to students in the Department of Chemical Engineering and Materials Science or approval of department; application required.
Physical processing of powders. Mixing and casting. Surface modification of ceramic, polymeric, and metallic materials in order to engineer the microstructure, properties, and form of components. Chemical and physical processing of materials. Powder synthesis and processing, consolidation, casting, microdevice fabrication and surface treatments, corrosion mitigation.
SA: MSE 385, MSE 380
Effective Summer 2005 Effective Spring 2013

MSE 381 Materials Characterization Methods II
Spring of every year. 2(1-3) P: (MSE 380 or concurrently) and (MSE 370 or concurrently) P: MSE 331 and (MSE 260 or concurrently) R: Open only to juniors or seniors in the Materials Science and Engineering major. R: Open to juniors or seniors in the Materials Science and Engineering major.
C: MSE 360 concurrently and MSE 370 concurrently.
X-ray and infrared spectroscopic analysis laboratory for the characterization of microstructure-property relationships. Effects of processing on microstructures, properties, and fracture surfaces in metal, ceramic, and polymer systems.
SA: MSE 376
Effective Fall 2005 Effective Fall 2012

MSE 425 Biomaterials and Biocompatibility
Spring of every year. 3(3-0) Interdepartmental with Biomedical Engineering. P: (PSL 250 or concurrently) and MSE 250 P: MSE 250 RB: PSL 250 R: Open to juniors or seniors in the College of Engineering.
Materials science of human implants. Design requirements imposed by the human body, and need for bodily protection.
SA: MSM 424, BME 424, BME 324, MSE 324 SA: BME 424, MSE 324
Effective Spring 2005 Effective Fall 2012

MSE 451 Spectroscopic and Diffraction Analysis of Materials
Spring of every year. 3(2-3) P: PHY 184 or PHY 184B or PHY 234B RB: MSE 350 and MSE 381 RB: MSE 260 and MSE 381 R: Open to juniors or seniors or graduate students in the College of Engineering or in the College of Natural Science.
SA: MSM 451
Effective Fall 2011 Effective Fall 2012

MSE 454 Ceramic and Refractory Materials
Fall of every year. 3(3-0) P: PHY 184 P: MSE 260 or approval of department RB: MSE 350 and MSE 381 RB: MSE 370 and MSE 381 R: Open only to seniors in the College of Engineering. R: Open to seniors in the College of Engineering.
Ceramic and glassy materials. High temperature processes. Mechanical and physical properties of technical ceramics.
SA: MSM 454
Effective Fall 2004 Effective Fall 2012

MSE 460 Electronic Structure and Bonding in Materials and Devices
Spring of every year. 3(3-0) P: MSE 260 R: Open to seniors in the Department of Chemical Engineering and Materials Science or approval of department; application required.

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MSE 466 Design and Failure Analysis (W)
Spring of every year. 3(2-3) P: ((MSE 331 and (MSE 381 or concurrently) and MSE 320) or approval of department) and completion of Tier I writing requirement. P: ((MSE 320 and MSE 381) or approval of department) and completion of Tier I writing requirement. R: Open to seniors in the College of Engineering.
Modes and causes of failure in mechanical components and role of design. Nondestructive evaluation. Legal and economic aspects of materials failure. Student projects.
SA: MSM 466
Effective Fall 2010 Effective Fall 2012

CE 405 Design of Steel Structures
Fall of every year. Spring of every year. 3(3-0) P: CE 305. R: Open to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering. R: Open to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering or in the College of Engineering.
Design of steel beams, columns, tension members and connections. Stability and plastic strength.
Effective Fall 2002 Effective Fall 2013

CE 406 Design of Concrete Structures
Fall of every year. Spring of every year. 3(3-0) P: CE 305 and CE 337. R: Open to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering. R: Open to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering or in the College of Engineering.
Design of reinforced concrete beams, slabs, columns and footings.
Effective Fall 2002 Effective Fall 2013

CE 492 Selected Topics in Civil Engineering
Fall of every year. Spring of every year. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.
Selected topics related to construction engineering, environmental engineering, fluid mechanics, geotechnical engineering, hydrology, pavements, structural engineering, or transportation engineering. Selected topics related to construction engineering, fluid mechanics, geotechnical engineering, hydrology, pavements, structural engineering, or transportation engineering.
Effective Fall 1998 Effective Fall 2012

CE 838 Bituminous Materials
Fall of even years. 3(2-3) RB: CE 431 and CE 432 and CE 461
NEW Superpave asphalt mix design, binder tests, hot mix asphalt performance tests, viscoelasticity, continuum damage models, image analysis methods.
Effective Fall 2012

ENE 483 Water and Wastewater Engineering
Fall of every year. 3(3-0) Interdepartmental with Civil Engineering. P: ENE 280 and (CE 321 or concurrently) P: (ENE 280 or BE 230) and (CE 321 or concurrently)
Scientific basis and design of physical, chemical and biological treatment methods for the control of water and air pollution. Operation and process selection.
Effective Summer 2012 Effective Fall 2012

ENE 489 Air Pollution: Science and Engineering
Spring of every year. 3(3-0) Interdepartmental with Civil Engineering. P: MTH 133 and (CEN 141 or CEN 151) and CE 280. P: (CEN 141 or CEN 151 or LB 171) and (MTH 133 or LB 119) and (ENE 280 or BE 230)
Basic physical and chemical principles governing indoor and atmospheric air pollution. Elements of air pollution meteorology, climate change, atmospheric transformations and transport. Air pollution sources and methods for their control. The role of local, state and federal government in air pollution control.
Effective Fall 2010 Effective Spring 2013
ENE 490 Independent Study
Fall of every year. Spring of every year. Summer of every year. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open to juniors or seniors in the Department of Civil and Environmental Engineering. Approval of department.
NEW Environmental engineering problem of specific interest to the student and a faculty member. May be analysis or design.
Effective Fall 2012

ENE 492 Selected Topics in Environmental Engineering
Fall of every year. Spring of every year. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.
NEW Selected topics related to environmental engineering, fluid mechanics and hydrology.
Effective Fall 2012

MSE 426 Introduction to Composite Materials
ME 426 Spring of every year. 3(3-0) Interdepartmental with Mechanical Engineering, Interdepartmental with Materials Science and Engineering P: ME 222 R: Open only to juniors or seniors in the College of Engineering.
SA: MSM 444
Effective Fall 2004 Effective Summer 2013