1. Approval of the minutes of December 4, 2015.

2. New Courses

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3. Change in Courses

   C1 College of Agriculture and Life Sciences
      Department of Animal Sciences
      ANSC 291, ANSC 485, ANSC 491, ANSC 494, DASC 485 – include zero credit

   C2 MSEN 201 – course title, description

   C3 MSEN 310 – course description

   C4 MSEN 410 – lec/lab hrs

   C5 MSEN 420 – course description, prerequisites

   C6 MSEN 460 – course title

   C7 MSEN 485 – include zero credit hours

   C8 MSEN 491 – include zero credit hours

   C9 POSC 491 – include zero credit hours

   C10 TCMG 476 – prerequisites

4. Change in Curricula

   College of Science
      Department of Physics and Astronomy

   D1 BA in Physics

   D2 BS in Physics

5. Special Consideration

   Dwight Look College of Engineering

   H1 Department of Materials Science and Engineering
      BS in Materials Science and Engineering
      Request for a new degree program

6. Texas A&M University at Qatar

   a. Change in Courses

   Q1c PETE 336 – course description

   Q2c PETE 436 – course description
b. Change in Curricula

**Texas A&M University at Qatar**
Petroleum Engineering Program
Q1d BS in Petroleum Engineering

7. Other Business
Report of the Undergraduate Curriculum Committee  
December 4, 2015

Members present: Tim Scott (Chair), College of Science; James Herman (Vice Chair), College of Veterinary Medicine and Biomedical Sciences; Bob Knight, College of Agriculture and Life Sciences; Leslie Feigenbaum, College of Architecture; Kisha Bryan, College of Education and Human Development; Prasad Enjeti, Dwight Look College of Engineering; Chris Houser, College of Geosciences; Nancy Street (for Steve Oberhelman), College of Liberal Arts; Brian Holland, College of Nursing; Glenn Jones, Texas A&M University at Galveston; Stephanie Graves, Texas A&M University Libraries; Kristin Harper (for Ann Kenimer), Undergraduate Studies; John Louis Bolch, Office of the Registrar; Jean Layne, Center for Teaching Excellence.

Guests: Nancy Klein, Department of Architecture; Gail Rowe, Department of Aerospace Engineering; Ashlea Schroeder, Department of Biological and Agricultural Engineering; John Keyser and Lynn Schlemeyer, Department of Computer Science and Engineering; Joe Horlen and Shelley Smith, Department of Construction Science; Ivan Damnjanovic, Department of Civil Engineering; Chris Cherry, College of Education and Human Development; Trez Jones, Department of Educational Administration and Human Resource Development; Aydin Karsilayan, Department of Electrical and Computer Engineering; Sally Kallina and Matthew Pariyothorn, Department of Engineering Academic and Student Affairs; Jay Porter, Department of Engineering Technology and Industrial Distribution; Craig Coates, Department of Entomology; Lori Greenwood, Paul Keiper and Alyssa Locklear, Department of Health and Kinesiology; Natarajan Gautam, Department of Industrial and Systems Engineering; Timothy Jacobs, Department of Mechanical Engineering; Ann Alexander, Department of Recreation, Park and Tourism Sciences; Steve Hague, Department of Soil and Crop Sciences; Tim McLaughlin, Department of Visualization.

The Undergraduate Curriculum Committee recommends approval of the following:

1. The minutes of the November 6, 2015 meeting.

2. New Courses

**AERO 451. Human Spaceflight Operations. (3-0). Credit 3.** Essential aspects of human spaceflight operations as performed by NASA; in-depth understanding of the state-of-the-art in spacecraft operations, including spacecraft systems, ground and launch operations, mission management and on-orbit activities such as science, robotics, spacewalking and human health maintenance; applications to future space systems. Prerequisite: Grade of C or better in AERO 321 or equivalent; senior classification.

**AGCJ 411. Audience and Communications Research Methods. (2-2). Credit 3.** Evaluation and implementation of research designs and methods used in audience and communications research; data collection methods and strategies, including interviews, observations, focus groups, surveys and content analyses, use of descriptive and comparative analyses to develop data-driven personas and recommendations for engaging target audiences. Prerequisite: Junior or senior classification.

**AGSC 305. Management of Supervised Agricultural Experiences. (3-0). Credit 3.** Overview of supervised agricultural experiences (SAEs) and content that can be used in the secondary agricultural science program; engagement in SAE programs; management practices for SAE projects including record keeping and student reports. Prerequisite: Junior or senior classification.

**ANSC 351. Current issues in Animal Agriculture. (3-0). Credit 3.** Preparation to project a professional image and the use of communication skills to describe animal agriculture; converse about the strengths and weaknesses of animal agriculture. Prerequisite: Junior or senior classification.

**ARAB 104. Intensive Beginning Arabic. (8-0). Credit 8.** Accelerated elementary language study, with oral, listening, reading and writing practice. Equivalent to ARAB 101 and ARAB 102.
ARAB 204. Intensive Intermediate Arabic. (6-0). Credit 6. Accelerated intermediate language study, with oral, listening, reading and writing practice. Equivalent to ARAB 201 and ARAB 202. Prerequisite: ARAB 102 or ARAB 104.

ARCH 281. Seminar in Contemporary Architecture. (1-0). Credit 1. Presentations by and discussions with professionals representing specialty areas related to environmental design through the Department of Architecture Lecture Series. May be taken four times for credit.

ARCH 353. History of Product Design. (3-0). Credit 3. History of product design in Europe and America including the relationship between designer and object, the relationship of design, industry and media over time and design criticism; focus on material/technical and typological approaches, comparative method and content analysis in context of original environment and social history. Prerequisite: Junior or senior classification or approval of instructor.

ARCH 381. Design Seminar. (1-0). Credit 1. Presentations by and discussions with professionals representing specialty areas related to architectural fabrication and product design. May be taken three times for credit. Prerequisite: Junior or senior classification or approval of instructor.

ATTR 201 Field Experience in Athletic Training I. (0-4). Credit 1. Field based experience in athletic training to provide on-the-job training designed to enhance and clarify career objectives; knowledge and skill development in professional behaviors, injury prevention and risk management. Prerequisite: Kinesiology majors.

ATTR 202. Field Experience in Athletic Training II. (0-4). Credit 1. Field based experience in athletic training to provide on-the-job training designed to enhance and clarify career objectives; knowledge and skill development in recognition and evaluation of common injuries and illnesses and their management. Prerequisite: ATTR 201.

ATTR 301. Field Experience in Athletic Training I. (0-4). Credit 1. Field based experience in athletic training to provide on-the-job training designed to enhance and clarify career objectives; knowledge and skill development in the treatment and rehabilitation of athletic injuries. Prerequisite: ATTR 202.

ATTR 302. Field Experience in Athletic Training II. (0-4). Credit 1. Field based experience in athletic training to provide on-the-job training designed to enhance and clarify career objectives; knowledge and skill development in athletic training administration; exploration of policy and position statements; professional development. Prerequisite: ATTR 301.

BAEN 484. Internship. No Credit. Practical experience working in a professional biological and agricultural engineering setting. May be taken three times. Prerequisite: Junior or senior classification; approval of the instructor.

BESC 311. International Perspectives on Environmental Issues. (3-0). Credit 3. Role of the United Nations and other institutions that promote international cooperation toward sustainable development goals; influence of cultural views on critical thinking about environmental issues, including population, water and agriculture, biodiversity and energy. Prerequisite: Junior classification or approval of instructor; must attend two mandatory pre-departure meetings.

CARC 181. First Year Seminar. (3-0). Credit 3. Seminar on various contemporary topics; introduction to high quality college instruction and research; focus on writing, speaking, exploration, discussion and
research. May be taken two times for credit. Prerequisite: First time in college and College of Architecture undergraduate studies.

CHIN 405. Modern Chinese Fiction. (3-0). Credit 3. Analysis of major Chinese literary and other prose works of the twentieth and twenty-first centuries; taught in English. May be taken two times for credit. Prerequisite: Junior or senior classification or approval of instructor.

CHIN 465. Chinese Film. (3-0). Credit 3. Consideration and analysis of major works and directors of Chinese film; interpretation of culture through film; relationship of film to history, literature and other arts; taught in English. May be taken two times for credit. Prerequisite: Junior or senior classification or approval of instructor. Cross-listed with FILM 465.

CSCE 451. Software Reverse Engineering. (2-2). Credit 3. Overview of the compilation mechanism to generate executable files and raw binary codes from source codes; executable file formats for an operating system to run the binary code; disassembly algorithms and control graph analysis; static and dynamic analyses; case studies on code obfuscation, codebreaking, malware analysis. Prerequisite: CSCE 313 or approval of instructor.

COSC 202. Introduction to Housing. (3-0). Credit 3. Overview of the social, economic, environmental and cultural impacts of housing on communities and nations; varied perspectives to understand the different facets of housing and their impacts on the human experience; critical thinking skills to gain knowledge and to be informed of housing choices.

COSC 310. Design and Construction Leadership Education I. (1-0). Credit 1. Promotion of personal leadership skills utilized within the design and construction professions; primary understanding and developing management skills with specific attention to developing personal attributes and skills necessary for achieving organizational goals. Prerequisites: CARC majors only pursuing the minor in leadership in the design & construction professions; junior or senior classification or approval of instructor.

COSC 333. Project Management for Facility Managers. (3-0). Credit 3. Overview of project management for facility managers covering concepts and components of project management and their interrelationships in construction practice. Prerequisite: Minor in facility management; junior or senior classification or approval of instructor.

COSC 410. Design and Construction Leadership Education II. (1-0). Credit 1. Development of competencies in various leadership and management practices that are useful in an array of situations; emphasis on organizational leadership and management development with specific attention to intragroup relationships and techniques for achieving group goals. Prerequisites: COSC 310, CARC majors only pursuing the minor in leadership in the design and construction professions; junior or senior classification or approval of instructor.

COSC 411. Seminar in Design and Construction Executive Leadership. (1-0). Credit 1. Promotes an understanding of leadership and builds the capacity to understand and meet the challenges involved in developing and leading ethical and sustainable organizations in today's economy; examination of theory, conceptualizing, reflection and application; share experiences in everyday life and learn to predict outcomes based on theoretical models. Prerequisite: COSC 410; CARC majors only pursuing the minor in leadership in the design and construction; junior or senior classification or approval of instructor.

CVEN 399. Mid-Curriculum Professional Development. No Credit. Participation in an approved high-impact learning practice; reflection on professional outcomes from civil engineering body of
knowledge; documentation of experience appropriate to eventual professional licensure; self-assessment of learning at mid-curriculum point. Prerequisites: CVEN 207, CVEN 250, CVEN 303, CVEN 306, CVEN 311, CVEN 322, CVEN 345 and CVEN 363.


ECEN 484. Professional Internship. (1-0). Credit 1. Professional internship in a private company, government agency or laboratory, university or organization to provide work and/or research experience related to the student’s major and career objectives. May be taken three times for credit. Prerequisites: Grade of C or better in ECEN 214 or ECEN 248; junior or senior classification; approval of instructor and internship agency.

ENDS 108. Design and Visual Communication Foundations II. (1-12). Credit 5. Approaches to problem identification and problem solving emphasizing human, physical and cultural factors influencing architectural design; understanding of space, materiality and tectonics in a human body scale; development of drawing methods with emphasis on analytical drawing; reinforcement of visual and verbal communication as applied to design processes. Prerequisite: ENDS 105 and ENDS 115.

ENGL 305. Texas Literature. (3-0). Credit 3. Examination of Texas literature, culture and multi-media; exploration of the development of Texas identities and responses to the rich cultural diversity within the state; topics vary from each section. Prerequisite: Junior or senior classification.

ENGR 380. Seminar Series in Engineering Project Management. (1-0). Credit 1. Presentations by practicing engineers and professionals addressing engineering project management process and practice; discussion forum to better understand the opportunities and challenges of engineering project management and the analytical tools and skills required to be successful. Must be taken on a satisfactory/unsatisfactory basis. Prerequisites: ENGR 333 or approval of instructor; junior or senior classification in the Dwight Look College of Engineering or biological and agricultural engineering (BAEN).

ENGR 430. Fundamentals of Subsea Engineering. (3-0). Credit 3. Orientation to subsea engineering fundamentals, including SURF (Subsea, Umbilicals/Controls, Risers, Flowlines) equipment and configurations; exposure to practical, industry focused problems; subsea equipment components; design considerations and design drivers; subsea production operations; integrity critical maintenance activities. Prerequisite: Junior or senior classification; enrolled in the Dwight Look College of Engineering or approval of instructor.

ENTO 209. Veterinary Entomology Laboratory. (0-2). Credit 1. Insects and their relatives causation of economic loss, impacts to well-being and transmission of disease pathogens to domestic and companion animals and wildlife, as well as health and well-being of humans through occupational or recreational exposure; laboratory emphasizes identification of major arthropod pests, use of microscopy and dissection equipment. Prerequisite: Concurrent enrollment with ENTO 208.

FILM 465. Chinese Film. (3-0). Credit 3. Consideration and analysis of major works and directors of Chinese film; interpretation of culture through film; relationship of film to history, literature and other
GEOG 391. Geodatabases. (3-1). Credit 3. GIS data modeling; introductory and advanced spatial SQL (structured query language); spatial database management system (DBMS) server setup, management and maintenance; spatial DBMS design, implementation, tuning, performance analysis and indexing; connecting spatial data services and warehouses to GIS software. Prerequisite: Junior or senior classification.

GEOL 102. Principles of Geology Laboratory. (0-2). Credit 1. Laboratory exercise-based introduction to the physical and chemical nature of the Earth and dynamic process that shape it; rock and mineral types; topographic and geologic maps; a complement to GEOL 101, but may be taken independently.

MATH 140. Mathematics for Business and Social Sciences. (3.0). Credit 3. (MATH 1324) Application of common algebraic functions, including polynomial, exponential, logarithmic and rational, to problems in business, economics and the social sciences; includes mathematics of finance, including simple and compound interest and annuities; systems of linear equations; matrices; linear programming; and probability, including expected value. No credit will be given for more than one of MATH 140, MATH 141 and MATH 166. Prerequisite: High school algebra I and II and geometry.

NRSC 350 Science of Mind and Brain. (3-0). Credit 3. Research in cognitive neuroscience; methodological advances that enable the study of the human brain safely in the laboratory; complex aspects of the mind like emotion, social behavior, and consciousness. Prerequisite: Junior or senior classification.

PHLT 484. Public Health Studies Field Experience. (3-0). Credit 3. On the job training in the area of public health studies industry; development of objectives and goals; evaluation by supervisor required. Prerequisites: Approval of instructor; junior or senior classification; public health major with a minimum overall 3.0 TAMU GPA.

PHYS 328. Experimental Physics II. (1-1). Credit 1. Laboratory experiments in modern physics and physical optics with an introduction to current, state-of-the-art recording techniques. Prerequisites: PHYS 225, PHYS 309, PHYS 327.

PHYS 416. Physics of the Solid State. (3-0). Credit 3. A survey of solid state physics; an introduction to crystal structures and the physics of electrons, lattice vibrations and photons; applications to semiconductors; magnetism; superconductivity; physics of nanostructures; brief introduction to selected current topics in condensed matter physics. Prerequisites: PHYS 304 and PHYS 412.

PSYC 350. Sciences of Mind and Brain. (3-0). Credit 3. Research in cognitive neuroscience; methodological advances that enable the study of the human brain safely in the laboratory; complex aspects of the mind like emotion, social behavior and consciousness. Prerequisite: Junior or senior classification. Cross-listed with NRSC 350.

SPAN 208. Spanish for Health Professionals I. (3-0). Credit 3. First half of a two-semester sequence for intermediate level Spanish; for those interested in careers in the health professions; presentation and practice of the most important basic communication functions in patient-provider interaction. Prerequisite: SPAN 102 or placement by exam.

SPAN 218. Spanish for Health Professionals II. (3-0). Credit 3. Second half of a two-semester course sequence for intermediate level Spanish; for those interested in careers in the health professions;
presentation and practice of the most important basic communication functions in patient-provider interaction. Prerequisite: SPAN 201, SPAN 208, or placement by exam with approval of instructor.

**SPAN 318. Oral Communication for Health Professionals. (3-0). Credit 3.** Development of advanced oral communication skills in Spanish within the context of the medical professions through discussion and study of health related and cultural issues relating specifically to the Latino/Hispanic community. Field trips, service learning, volunteering, interviews, impromptu speaking and formal presentations may be required. Prerequisite: Junior or senior classification or approval of instructor with placement exam, or SPAN 202 or SPAN 218.

**SPAN 407. Spanish-English Translation. (3-0). Credit 3.** Foundations of translation methodology, strategies and practice; rendering of literary and non-literary texts; ethics of translation; emphasis on translation into the first language. Prerequisite: 6 credits of upper division SPAN with a grade of B or better or approval of instructor.

**SPAN 417. Advance Spanish-English Translation. (3-0). Credit 3.** Expansion of translation practice and development of lexical and stylistic competence in specialized fields, including commercial, legal, medical, technical and scientific; mandatory service learning component included. Prerequisite: SPAN 407 with a grade of B or better or approval of instructor.

**SPMT 481. Seminar. (1-0). Credit 1.** A variety of topical seminars in communicating contemporary and historical sport management subjects designed to complement the curriculum in sport management. May be taken three times for credit. Prerequisite: Admission to the professional phase of the sport management program; junior or senior classification; or approval of instructor.

**VIBS 243. Introductory Mammalian Histology. (1-2). Credit 2.** Biological aspects of the human body by integrating histology and anatomy and physiology; emphasis on the transition of cell and tissue organization to organ systems that comprise mammalian organisms; builds upon concepts introduced in lower-level biology and builds a foundation to succeed in upper-level histology, anatomy and physiology.

**VIST 432. Applied Perception. (3-0). Credit 3.** An advanced introduction to perceptual science, including the cognitive, neural and evolutionary processes that undergird perceptual systems as well as the variety of perceptual factors that influence design decision. Prerequisite: Visualization major; junior or senior classification or approval of instructor.


3. Change in Courses

**AERO 291. Research.**

Variable credit hours
From: Credit 1 to 4.
To: Credit 0 to 4.
AERO 491. Research.

Variable credit hours
  From: Credit 1 to 4.
  To: Credit 0 to 4.


Prerequisites
  From: ENDS 116 or approval of instructor.
  To: None.


Prerequisites
  From: Junior or senior classification, or approval of instructor; ENDS 106.
  To: Junior or senior classification or approval of instructor; ARCH 216 or approval of instructor.

ARCH 433. Architectural Lighting.

Prerequisites
  From: Junior or senior classification.
  To: ARCH 335 or junior or senior classification in EDAS.

BMEN 428. Microcontrollers & Comm. in Medical Devices.

Lecture and lab contact hours
  From: (3-0). Credit 3.
  To: (2-3). Credit 3.

CHEN 204. Elementary Chemical Engineering.

Lecture and lab contact hours
  From: (3-0). Credit 3.
  To: (2-3). Credit 3.

Prerequisites
  From: Admission to chemical engineering major or approval of instructor.
  To: Grade of C or better in CHEM 102, CHEM 112, ENGR 112, MATH 152 and PHYS 218; admission to chemical engineering major; or approval of instructor.

COMM 475. Media and the Middle East.

Course number
  From: COMM 475.
  To: COMM 367.
ECEN 314. Signals and Systems.

Lab contact hours
From: (3-0). Credit 3.
To: (3-1). Credit 3.

ENGL 320. Technical Editing and Writing.

Course title
From: Technical Editing and Writing.
To: Technical and Professional Editing.

Course description
From: Clarifying, reducing, expanding and synthesizing such technical materials created by others as manuals, annual reports, and technical articles and reports; audience adaptation, invention, organization, style and mechanics explored.
To: Principles and techniques of technical editing for print and electronic media, including standards, style, copy-editing, comprehensive editing and project management.

ENGL 460. Writing for the Web.

Course title
From: Writing for the Web.
To: Digital Authoring Practices.

Course description
From: Integration of technology instruction and proven technical communication strategies for developing effective audience-appropriate websites (infrastructure, structure, content, design, and navigation); focus on rhetorical shifts of the Internet medium, as well as ethical, sociocultural and legal issues, including web accessibility.
To: Analysis and practice of authoring in digital environments, including individual and collaborative approaches, audience concerns, theoretical, ethical and stylistic issues; environments and topics may include web design, content management system (CMS), text encoding, project management, usability, version tracking, content authoring and accessibility.

ENGR 291. Research.

Variable credit hours
From: Credit 1 to 4.
To: Credit 0 to 4.

ENGR 491. Research.

Variable credit hours
From: Credit 1 to 4.
To: Credit 0 to 4.
ENTO 208. Veterinary Entomology.

Lab contact hours and semester credit hours
From: (2-2). Credit 3.
To: (2-0). Credit 2.

Course description and prerequisites
From: Classification, biology and control of insects and other arthropods associated with livestock and poultry production; identification emphasized in laboratory.
To: Insects and their relatives causation of economic loss, impacts to well-being and transmission of disease pathogens to domestic and companion animals and wildlife as well as health and well-being of humans through occupational or recreational exposure; insect biology, economic importance and principles and methods of prevention and control.

GEOG 203. Plant Earth.

Lab contact hours
From: (3-0). Credit 3.
To: (3-1). Credit 3.


Prerequisites
From: GEOG 361 and GEOG 475 or equivalents, or approval of instructor; junior or senior classification.
To: GEOG 361, GEOG 390, GEOG 475; CSCE 110 or CSCE 111.

GEOG 484. Internship.

Course description
From: Directed internship in a private firm, government agency, or non-governmental organization to provide work experience related to the student's degree program and career objectives. May be taken 2 times for credit.
To: Directed internship in a private firm, government agency or non-governmental organization to provide work experience related to the student's degree program and career objectives.


Lab contact hours
From: (3-0). Credit 3.
To: (3-1). Credit 3.

JOUR 304. Editing for the Mass Media.

Lecture and lab contact hours
From: (2-2). Credit 3.
To: (3-0). Credit 3.
Course description and prerequisites
From: Principles and practice of editing including: improving and tightening print and broadcast copy; writing headlines, titles and subheads; photo editing and cutlines; graphics and layout. Prerequisites: JOUR 203, junior or senior classification and enrollment in journalism minor; or approval of program director.*To: Principles and practice of editing including: improving and tightening text; writing headlines, titles and subheads; self-editing and editing others; tailoring texts for specific audiences; understanding style guides. Prerequisites: Junior or senior classification; or approval of program director.

KINE 223. Introduction to the Science of Health and Fitness.

Course description
From: Overview of the human body systems; interdisciplinary focus on wellness, fitness, nutrition, disease, drug use; integrated physical activity centering on principles and applications of conditioning; collect data, evaluate information, formulate plans based on findings; experience with pedometers, heart rate monitors, bioelectrical impedance devices, software and other technology. Not open to students who have taken KINE 120.

To: Overview of the human body systems; interdisciplinary focus on wellness, fitness, nutrition, disease, drug use; integrated physical activity centering on principles and applications of conditioning; collect data, evaluate information, formulate plans based on findings; experience with pedometers, heart rate monitors, bioelectrical impedance devices, software and other technology.

LAND 200. Introduction to Landscape Architectural Practice.

Course number
From: LAND 200.
To: LAND 101.

Cross-listing
From: Cross-listed with URPN 200.
To: Cross-listed with URPN 101.

LAND 254. Landscape Architecture Communications I.

Course number
From: LAND 254.
To: LAND 111.

LAND 255. Landscape Architectural Communications II.

Course number
From: LAND 255.
To: LAND 112.

LAND 318. Landscape Design I.

Course number
From: LAND 318.
To: LAND 211.
LAND 319. Landscape Design II.

Course number
From: LAND 319.
To: LAND 212.

LAND 320. Landscape Design III.

Course number
From: LAND 320.
To: LAND 311.

Course description
From: Design process, synthesis and design refinement; problems to stimulate highly creative self-motivated results, design thinking to integrate behavioral settings into natural and/or built landscape systems.
To: Design process, sustainable landscape design, synthesis and design refinement; problems to stimulate highly creative self-motivated results, design thinking to integrate behavioral settings into natural and/or built landscape systems.

LAND 321. Landscape Design IV.

Course number
From: LAND 321.
To: LAND 312.

Course description
From: Continuation of LAND 320; land design projects of increased complexity with site scale problems used to demonstrate complete design thought. One or more field trips may be required as part of the course.
To: Continuation of LAND 311; land design projects of increased complexity and emphasis on sustainability, with site scale problems used to demonstrate complete design thought. One or more field trips may be required.

LAND 330. Landscape Construction II.

Course number
From: LAND 330.
To: LAND 232.

LAND 421. Landscape Design VI.

Course number
From: LAND 421.
To: LAND 412.
Course description
From: Advanced study and research designed to take the student beyond the core design experience; introduction of issues, methodologies, tools and techniques developing in professional practice.
To: Capstone studio; advanced study and research designed to go beyond the core design experience; introduction of issues, methodologies, tools and techniques developing in professional practice.

LAND 442. Professional Practice.

Course number
From: LAND 442.
To: LAND 431.

MATH 141. Business Mathematics I.

Course title
From: Business Mathematics I.
To: Finite Mathematics.

Course description
From: Linear and quadratic equations and applications; functions and graphs, systems of linear equations, matrix algebra and applications, linear programming, probability and applications, statistics. No credit will be given for more than one of MATH 141 and MATH 166.
To: Linear equations and applications; systems of linear equations, matrix algebra and applications, linear programming, probability and applications, statistics. No credit will be given for more than one of MATH 140, MATH 141 and MATH 166.

MATH 142. Business Mathematics II.

Course title
From: Business Mathematics II.
To: Business Calculus.

Prerequisites
From: High school algebra I and II and geometry or satisfactory performance on a qualifying examination
To: MATH 140 or equivalent or acceptable score on Texas A&M University math placement exam.

MATH 166. Topics in Contemporary Mathematics II.

Course description
From: Finite mathematics, matrices, probability and applications. No credit will be given for more than one of MATH 141 and MATH 166.
To: Finite mathematics, matrices, probability and applications. No credit will be given for more than one of MATH 140, MATH 141 and MATH 166.
MEEN 357. Engineering Analysis for Mechanical Engineers.

Prerequisites
From: ENGR 112 and MATH 308.
To: ENGR 112 and MATH 308; MEEN 210 or concurrent enrollment.

MEEN 360. Materials and Manufacturing Selection in Design.

Prerequisites
From: MEEN 222, MEEN 260; CVEN 305; junior or senior classification; or approval of instructor.
To: MEEN 210, MEEN 222, MEEN 260; CVEN 305; junior or senior classification.

MEEN 363. Dynamics and Vibrations.

Prerequisites
From: MEEN 225; MATH 308; MEEN 357 or CVEN 302, or registration therein; CVEN 305 or registration therein.
To: MEEN 225; MATH 308; MEEN 357 or concurrent enrollment; CVEN 305 or concurrent enrollment.

OCNG 251. Oceanography.

Lab contact hours
From: (3-0). Credit 3.
To: (3-1). Credit 3.

PHYS 327. Experimental Physics I.

Lecture and lab contact hours and semester credit hours
From: (2-3). Credit 3.
To: (1-2). Credit 2.

SCMT 340. Supply Chain Management.

Course title
From: Supply Chain Management.
To: Global Supply Chain Management.

Course description
From: Focus on the integrated management of the total product delivery system; purchasing, inventory management and distribution functions, with emphasis on materials and information flows.
To: Extend knowledge of basic concepts of transportation and logistics to specialized situations in international business in order to understand (a) the international trade and commercial environment, (b) exporting and importing documentation and procedures and (c) operations involving international shipping and transportation.
SCSC 305. Production Agronomy Experience.

Course title
From: Production Agronomy Experience.
To: Professional Development in Agronomy.

Course description
From: Agronomy industry practices related to crop production; site visits in Texas and in the Mississippi Delta include a review of farming equipment, conservation agriculture practices, agro-chemical distribution and sales, grain product processing and distribution and on-farm management techniques.
To: Enhancement of human relation skills related to a career in soil and crop sciences; field trip to Mississippi to interact with leadership from a global agricultural company; on-campus experiences to improve effective learning practices, job seeking and retention and setting and achieving near-term and long-term professional goals.

SCSC 312. Introductory Turfgrass Management Laboratory.

Course title
From: Introductory Turfgrass Management Laboratory.
To: Professional Development in Turfgrass.

Course description
From: Fundamentals of turfgrass anatomy, growth habit, identification and characteristics of cool- and warm-season turfgrass species; understanding of seed quality and labeling, pesticide safety, handling, and application, and fertilizer sources, safety, and application; specialized equipment used in the turfgrass industry.
To: Includes but not limited to fertilizer, pesticide, irrigation calculations; turfgrass, insect and weed identification and management, soils and rootzone construction; irrigation system operation and auditing; sprayer and spreader operation and calibration; builds upon and allows application of information obtained in SCSC 302; designed to better prepare those intending to compete in the GCSAA and STMA Collegiate Turf Bowl competitions.

SPMT 482. Seminar.

Course title
From: Seminar.
To: Professional Writing Seminar.

Course description
From: Acquaint students with current research and the research process in their chosen field of study (sport management). May be taken 4 times for credit.
To: Acquaint students with a primary means of communicating contemporary research in sport management; extensive readings, intensive writings and an oral presentation designed to complement the curriculum in sport management by introducing the application of sport management research to organizational decision making.


Course title
To: Cybersecurity and Digital Ethics.

4. Change in Curriculum

**College of Agriculture and Life Sciences**
Department of Biological and Agricultural Engineering
BS in Agricultural Systems Management

Department of Nutrition and Food Science
BS in Food Science and Technology – Food Science Option
BS in Food Science and Technology – Industry Option

**College of Architecture**
Department of Architecture
BED in Environmental Design Architectural Studies

Department of Construction Science
Minor in Facility Management

Department of Visualization
Minor in Art

**Mays Business School**
Minor in Business Administration

Department of Information and Operations Management
BBA in Management Information Systems
BBA in Supply Chain Management

**College of Education and Human Development**
Department of Health and Kinesiology
BS in Health – Allied Health Track

Minor in Sport Management

**Dwight Look College of Engineering**
Department of Computer Science and Engineering
BS in Computer Science

Department of Engineering Technology and Industrial Distribution
BS in Manufacturing and Mechanical Engineering Technology

Department of Engineering Technology and Industrial Distribution
BS in Industrial Distribution

Department of Industrial and Systems Engineering
Minor in Industrial Engineering
College of Geosciences

- BS in Environmental Geosciences
- BS in Environmental Studies
- Minor in Climate Change
- Minor in Earth Sciences
- Minor in Environmental Geosciences

Department of Geography
- BS in Geographic Information Science and Technology
  All tracks

Department of Oceanography
- BS in Environmental Geosciences and MS in Oceanography – 3+2

Department of Geology and Geophysics
Department of Oceanography
- BA in Geology and MS in Oceanography – 3+2
  
  BS in Geology and MS in Oceanography – 3+2

Department of Atmospheric Sciences
Department of Oceanography
- BS in Meteorology and MS in Oceanography – 3+2

College of Liberal Arts

- Minor in Liberal Arts Honors

Department of Communication
- BA in Communication
  
  BA in Telecommunication Media Studies
  
  BS in Telecommunication Media Studies

Department of History
- BA in History

Department of Sociology
- BA in Sociology
  
  BA in Sociology and MPSA – 3+2
  
  BS in Sociology
  
  BS in Sociology and MPSA – 3+2

- Minor in Latina/o and Mexican-American Studies
College of Science
Department of Mathematics
BS in University Studies - Mathematics for Business Concentration

BS in University Studies - Mathematics for Teaching

5. Texas A&M University at Galveston

a. New Courses

**DIVE 250. SCUBA Diving I.** (2-2). Credit 3. Fundamental academic knowledge and practical application of SCUBA diving practices and theory; introduction to diving tables and diving physiology. Prerequisite: Must complete a medical statement showing no contraindications to diving, or have a recreational SCUBA diver's physical examination.

**DIVE 251. SCUBA Diving II.** (2-2). Credit 3. Methods to promote safe, self-reliant diving and improve the diver's comfort, coordination and strength in the water; to build competency in dive planning and organization. Prerequisite: Must complete a medical statement showing no contraindications to diving, or have a recreational SCUBA diver's physical examination; open water certification from a nationally recognized agency; Divers Alert Network (DAN) insurance or equivalent.

**DIVE 330. Rescue Diving.** (2-2). Credit 3. Relates skills necessary to perform basic life support, administer dive first aid, evacuate victim, assist and rescue other divers in water; illustrate proper dive planning; practice accident prevention and effective accident management. Prerequisites: Must complete a medical statement showing no contraindications to diving, or have a recreational SCUBA diver's physical examination; certification as a SDI SCUBA diver or equivalent; Divers Alert Network (DAN) diving accident insurance or equivalent.

**DIVE 331. Alternative Diving Technology.** (2-2). Credit 3. Illustrates the realities of operating in the scientific, public safety and military diving disciplines; practice real world training scenarios involving multiple aspects of each of the three fields. Prerequisites: Must complete a medical statement showing no contraindications to diving, or have a recreational SCUBA diver's physical examination (or AAUS physical if rating with AAUS); certification as an Advanced and Rescue Diver or equivalent; Divers Alert Network (DAN) diving accident insurance or equivalent; junior or senior classification or approval of instructor.

**DIVE 357. Dive Leadership – Divemaster.** (2-2). Credit 3. Examines divemaster-level dive knowledge, dive leadership theory and application, presentations skills, physical diving skills, logistics and planning, and operational execution; develops a multi-environment capable diving leader. Prerequisites: Must complete a medical statement showing no contraindications to diving, or have a recreational SCUBA diver's physical examination; certification as a SDI Advanced SCUBA Diver and SDI SCUBA Rescue Diver or equivalent; 60 varied dives logged; current certifications in First Aid, CPR and Emergency Oxygen Administration; Divers Alert Network (DAN) diving accident insurance (or equivalent); junior or senior classification or approval of instructor.

**DIVE 457. Dive Leadership – Instructor.** (2-2). Credit 3. Apply effective methods to teach skin and SCUBA diving in compliance with training agency instructional standards; evaluate instructional level dive knowledge, water skills and presentation performance in accordance with training agency teaching standards. Prerequisites: Recreational SCUBA diver’s medical evaluation; certification as a
b. Withdrawal of Courses

MAST 110. Scuba Lecture.
MAST 120. Scuba II Lecture.
MAST 331. Alternate Diving Technology.
MAST 357. Diving Leadership-Divemaster.
MAST 457. Dive Leadership-Dive Instructor.

c. Change in Course

**MASE 319. Naval Architecture Design I.**

Prerequisites

From: CVEN 311, CVEN 345; MASE 221, MASE 214. Junior or senior classification or approval of instructor. Enrollment in OCSE major degree sequence.

To: CVEN 311 and CVEN 345 or concurrent enrollment; MASE 221 and MASE 214 or concurrent enrollment; junior or senior classification or approval of instructor; enrollment in OCSE major degree sequence.

CIP code

From: 1424010006.
To: 1422010006.

6. Texas A&M University at Galveston

d. Change in Curriculum

**Texas A&M University at Galveston**
Department of Liberal Studies
Minor in Diving Technology and Methods

Department of Marine Biology
BS in Marine Biology – License Option

7. Special Consideration

**College of Agriculture and Life Sciences**
Department of Recreation, Park and Tourism Sciences
BS in Community Development
Request to discontinue degree program

**College of Architecture**
Department of Architecture
Minor in Architectural Fabrication and Product Design
Request for a new minor
Department of Construction Science
   Minor in Leadership in the Design and Construction Professions
   Request for a new minor

Department of Visualization
   Minor in Game Design and Development
   Request for a new minor

**College of Education and Human Development**
   Department of Health and Kinesiology
   BS in Kinesiology and MS in Athletic Training
   Request for a new 3+2 program

**Dwight Look College of Engineering**
   Minor in Cybersecurity
   Request for a new minor

   Minor in Engineering Project Management
   Request for a new minor

   Department of Computer Science and Engineering
   Minor in Game Design and Development
   Request for a new minor

8. **New Courses – from November 2015 UCC Meeting**

   **AGSM 284. Internship. No Credit.** Practical experience working in a professional agricultural systems management setting. May be taken three times. Prerequisite: Freshman or sophomore classification; approval of the instructor.

   **AGSM 484. Internship. No Credit.** Practical experience working in a professional agricultural systems management setting. May be taken three times. Prerequisite: Junior or senior classification; approval of the instructor.

   **BAEN 284. Internship. No Credit.** Practical experience working in a professional biological and agricultural engineering setting. May be taken three times. Prerequisite: Freshman or sophomore classification; approval of the instructor.
NEW COURSES
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

Form Instructions
1. Course request type: ☑ Undergraduate ☐ Graduate ☐ First Professional (DDS, MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
MSEN 210, Thermodynamics of Materials
3. Course prefix, number and complete title of course:
4. Catalog course description (not to exceed 50 words):
Basic concepts and fundamental laws of thermodynamics; processes and thermodynamic engines; phase equilibria and phase diagrams of simple substances; chemical reactions of condensed phases; computational software for thermodynamic and phase diagram calculations.

5. Prerequisite(s):
MSEN 201 or registration therein, MATH 152 or registration therein.

Cross-listed with:
MSEN 210 or registration therein.

Stacked with:

Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course? ☐ Yes ☑ No
If yes, from _______ to _______.
7. Is this a repeatable course? ☐ Yes ☑ No
If yes, this course may be taken _______ times.
Will this course be repeated within the same semester? ☐ Yes ☑ No
8. Will this course be submitted to the Core Curriculum Council? ☐ Yes ☑ No
9. How will this course be graded? ☑ Grade ☐ S/U ☑ P/F (CLMD)
10. This course will be:
a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
   B.Sc. in Materials Science and Engineering
b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

12. ☑ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-control/basics-for-distance-education).

13. Prefix Course # Title (excluding punctuation)
MSEN 210 THERMODYNAMICS MATERIALS

<table>
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<th>Admin. Unit</th>
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</table>

Approval recommended by:

Ibrahim Karanam

Department Head or Program Chair (Type Name & Sign) Date Chair, College Review Committee Date

Department Head or Program Chair (Type Name & Sign) Date Dean of College Date

Submitted to Coordinating Board by:

Chair, GC or UCC Date

Associate Director, Curricular Services Date

Questions regarding this form should be directed to Sandra Williams at 845.829.1 or sandra.williams@tamu.edu
Curricular Services – 07/14

RECEIVED
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RECEIVED
DEC 2 1 2015
CURRICULAR SERVICES
MSEN 210, Thermodynamics of Materials
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Raymundo Arroyave, Reed McDonald Bldg. 218, rarrowave@tamu.edu, 979-777-7116

Course (catalog) description: Introduction to basic concepts and fundamental laws of thermodynamics; processes and thermodynamic engines; phase equilibria and phase diagrams of simple substances; chemical reactions of condensed phases; computational software for thermodynamic and phase diagram calculations.

Course Prerequisites: MSEN 201 or registration therein, MATH 152 or registration therein.

Learning Outcomes: At the end of this course, students should be able to:
1. Understand and explain the fundamental laws of thermodynamics
2. Use thermodynamic principles to interpret phase equilibria, and chemical reactions
3. Apply the concept of equilibrium and free energy minimization to construct phase diagrams
4. Calculate phase diagram and thermodynamic properties using computational thermodynamics software.


Supplementary References:
Thermodynamics in Materials Science, Robert DeHoff, CRC Press (2nd Edition)

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 Introduction and Definition of Terms
Week 2 The First Law of Thermodynamics
Week 3 The Second Law of Thermodynamics
Week 4 Statistical Interpretation of Thermodynamics
Week 5 Auxiliary Functions
Week 6 Heat Capacity, Enthalpy, and Entropy
Week 7 The Third Law of Thermodynamics
Week 8 Phase Equilibrium in a One-Component System
Week 9 Introduction to Computational Thermodynamics Software
Week 10 The Behavior of Solutions
Week 11 Gibbs Free Energy, Composition and Phase Diagrams of Binary Systems
Week 12 Reactions involving Pure Condensed Phases and a Gaseous Phase
Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Proper understanding and application of thermodynamics will be evaluated through written exams, homeworks, quizzes, projects, and in-class participations. In addition, students will be guided to use computational software Thermo-Calc for thermodynamic and phase diagram calculations in the projects and homeworks. These activities will help assess student learning and understanding of the knowledge taught in the course.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Midterm Exam (30%) \{Week 7\}
Comprehensive Final (35%) \{end of semester\}
Homework (10%)
Quizzes (10%)
Project (10%)
In-Class Participation (5%)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell-phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.
The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at: https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
- Submit original form and attach a course syllabus.

Form Instructions
1. Course request type:
   - [ ] Undergraduate
   - [ ] Graduate
   - [ ] First Professional (DVM, MD, JD, PharmD, DPA)
2. Request submitted by (Department or Program Name):
   Department of Materials Science and Engineering
3. Course prefix, number and complete title of course:
   MSE 220, Physics and Chemistry of Inorganic Materials

4. Catalog course description (not to exceed 50 words):
   Structure, properties, and function of materials developed from an atomistic and molecular perspective emphasizing quantum chemical descriptions; elements of solid-state chemistry and physics including bonding, crystal structure and symmetry, origin of electronic band structure; synthesis and characterization tools in materials chemistry; role of finite size effects

5. Prerequisite(s):
   PHY 208 (co-requisite) OR CHEM 102 (co-requisite)

6. Is this a variable credit course?
   - [ ] Yes
   - [ ] No
   If yes, from ________ to ________

7. Is this a repeatable course?
   - [ ] Yes
   - [ ] No
   If yes, this course may be taken ________ times.

8. Will this course be repeated within the same semester?
   - [ ] Yes
   - [ ] No

9. Will this course be submitted to the Core Curriculum Council?
   - [ ] Yes
   - [ ] No

10. How will this course be graded?
    - [ ] Grade
    - [ ] S/U
    - [ ] Pass/Fail

11. This course will be:
    a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
    B.Sc. in Materials Science and Engineering
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

12. [ ] I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-control/export-controls/basics-for-distance-education).

13. Prefix | Course # | Title (excluding punctuation)
    MSE 220 | PHYS & CHEM INORGANIC MATLS

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</table>

Approval recommended by:

Ibrahim Karanam  
Department Head or Program Chair (Type Name & Sign)  
Date 12/15/2015

Chair, College Review Committee  
Date

Department Head or Program Chair (Type Name & Sign)  
Date

If cross-listed course

Dean of College  
Date

Submitted to Coordinating Board by:

Associate Director, Curricular Services  
Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu
Curricular Services • 07/14
MSEN220, Physics and Chemistry of Inorganic Materials  
(To be cross-listed as CHEM/MSEN 220 in future)  
3 Credits

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information: Dr. Sarbajit Banerjee/Dr. James Batteas  
Chemistry 222, banerjee@chem.tamu.edu, 979-862-3102  
Chemistry 2119C, batteas@chem.tamu.edu, (979) 458-2965

Course (catalog) description: Structure, properties, and function of materials developed from an atomistic and molecular perspective emphasizing quantum chemical descriptions; elements of solid-state chemistry and physics including bonding, crystal structure and symmetry, origin of electronic band structure; synthesis and characterization tools in materials chemistry; role of finite size effects

Course Prerequisites: PHY 208 (co-requisite) OR CHEM 102 (co-requisite)

Learning Outcomes: At the end of this course, students should be able to:  
1. Have an understanding of common crystal structures and their representations  
2. Recognize how symmetry and chemical bonding influence structures adopted by inorganic materials  
3. Describe the role of valence electron structure in the resulting bonding present in solids.  
4. Relate the origin of electronic band structure in materials.  
5. Possess a basic understanding of analytical methods that can be applied to study materials and be able to devise testing plans  
6. Appreciate the role of finite size in influencing the properties of materials


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:  
Week 1: Common structure types in solid-state chemistry  
Week 2: Visualization and representation of crystal structures  
Week 3: Rationalizing structure types  
Week 4: Crystal field theory and lattice energetics  
Week 5: Symmetry operations and point groups  
Week 6: Space groups and Bravais lattices  
Week 7: Elementary crystallography  
Week 8: Chemical bonding and band structure: from bonds to bands  
Week 9: Simple models of electronic structure
Week 10  Optical and electronic properties
Week 11  Quantum size effects
Week 12  Synthetic strategies in materials chemistry
Week 13  An introduction to defect chemistry
Week 14  Extended defects

Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Understanding of the content will be assessed through graded problem sets, three in-class exams, a final exam, and a literature assignment.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Problem sets: 20% (Weekly)
Midterm exams: 45% (Weeks 4 & 8)
Literature assignment: 10%
Final exam: 25%

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer's discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
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      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
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10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

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The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University
Departmental Request for a New Course
Undergraduate + Graduate + Professional
• Submit original form and attach a course syllabus.

Form Instructions:
1. Course request type:
   - [ ] Undergraduate
   - [ ] Graduate
   - [ ] First Professional (DDS, MD, JD, PharmD, DVM)

2. Request submitted by (Department or Program Name):
   Department of Materials Science and Engineering

3. Course prefix, number and complete title of course:
   MSEN 240, Kinetics of Materials

4. Catalog course description (not to exceed 50 words):
   Application of physical principles that drive evolution of materials as they approach thermodynamic equilibrium states; topics include: Gibbs free energy, driving forces, point defects, diffusion in solids, interface and grain boundary motion, nucleation, growth, transformation diagrams, precipitation, phase separation, ordering, solidification.

5. Prerequisite(s):
   MSEN 210
   Cross listed with:

6. Is this a variable credit course?
   [ ] Yes
   [ ] No
   If yes, from _______ to _______.

7. Is this a repeatable course?
   [ ] Yes
   [ ] No
   If yes, this course may be taken _______ times.

8. Will this course be repeated within the same semester?
   [ ] Yes
   [ ] No

9. Will this course be submitted to the Core Curriculum Council?
   [ ] Yes
   [ ] No

10. How will this course be graded?
   - [ ] Grade
   - [ ] S/U
   - [ ] P/F (C/NC)

11. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
      B.Sc. in Materials Science and Engineering
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

12. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

13. Prefix  Course #  Title (excluding punctuation)
    MSEN  240  KINETICS IN MATERIALS
    Lect.  Lab  Other  SCH  CIP and Fund Code  Admin. Unit  Acad. Year  FICE Code
    3.00  0.00  0.00  3.00  4010010002  1864  17 - 18  0 0 3 6 3 2

   Approval recommended by:
   Ibrahim Karahan
   Departed Head or Program Chair (Type Name & Sign)  Date

   Chair, College Review Committee
   Date

   Department Head or Program Chair (Type Name & Sign)  Date
   (if cross-listed course)

   Dean of College
   Date

   Submitted to Coordinating Board by:
   Chair, GC or GCC
   Date

   Associate Director, Curricular Services
   Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services – 07/14
MSEN 240, Kinetics of Materials
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Raymundo Arroyave, Reed McDonald Bldg. 218, rrooyave@tamu.edu, 979-777-7116

Course (catalog) description: Application of physical principles that drive the evolution of materials as they approach thermodynamic equilibrium states; topics include: Gibbs free energy, driving forces, point defects, diffusion in solids, interface and grain boundary motion, nucleation, growth, transformation diagrams, precipitation, phase separation, ordering, solidification.

Course Prerequisites: MSEN 210

Learning Outcomes: At the end of this course, students should be able to:
1. Quantify driving forces for phase transformations by comparing Gibbs energies of phases taking part in transformation.
2. Apply physical principles to the quantification of rates of evolution in materials systems.
3. Use understanding of different kinds of solid-solid phase transformations (precipitation, segregation, ordering, martensitic transformation) and their influence on microstructure evolution in materials.
4. Interpret materials microstructures in terms of possible transformation paths
5. Interpret transformation diagrams and to use them to design materials processing parameters
6. Understand how cooling rates and thermal gradients affect microstructures observed during solidification processes.

Textbook: Phase Transformations in Metals and Alloys, Porter and Easterling, Second Edition,

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:

Week 1 Thermodynamics in Phase Transformations
Week 2 Driving Forces for Materials Evolution
Week 3 Phenomenology of Diffusion Equation
Week 4 Strategies for the Solution to the Diffusion Equation: Steady State
Week 5 Strategies for the Solution to the Diffusion Equation: Non-steady State
Week 6 Atomistic Basis for Diffusion
Week 7 Diffusion in liquids, polymers and amorphous materials
Week 8 Interface and Grain Boundary Motion
Week 9 Nucleation and Growth
Week 10 Precipitation
Week 11  Phase Separation
Week 12  Ordering
Week 13  Martensitic Transformations
Week 14  Relationships between Phase Transformations and Microstructures

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course will be evaluated through quizzes, homework, exams and a final paper.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Homework:  30% \{Weekly\}
Exam 1:  20% \{Week 4\}
Exam 2:  20% \{Week 8\}
Quizzes:  10%
Final paper:  20% \{Week 14\}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer's discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell-phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university
-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   iv. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      c) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      d) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: *"An Aggie does not lie, cheat, or steal or tolerate those who do."* For additional information please visit: http://aggiehonor.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University
Departmental Request for a New Course
Undergraduate + Graduate + Professional
Submit original form and attach a course syllabus.

Form Instructions:
1. Course request type:  
   - [x] Undergraduate  
   - [ ] Graduate  
   - [ ] First Professional (DMD, MD, JD, Ph.D., DVM)
2. Request submitted by (Department or Program Name):
   - Department of Materials Science and Engineering
3. Course prefix, number and complete title of course:
   - MSEN 250, Soft Matter

4. Catalog course description (not to exceed 50 words):
   - Structure, properties, and function of various classes of soft matter including colloids, polymers, amphiphils, liquid crystals, and biomacromolecules; basic concepts of viscoelasticity, glass transition, liquid-liquid and liquid-solid transitions and gelation; forces acting between mesoscopic objects; supramolecular self-assembly in soft condensed matter.

5. Prerequisite(s):
   - PHYS 208, CHEM 102, CHEM 112
   - Cross-listed with:
   - Stacked with:

6. Is this a variable credit course?  
   - [ ] Yes  
   - [x] No  
   - [ ] If yes, from ______ to ______

7. Is this a repeatable course?  
   - [ ] Yes  
   - [x] No  
   - If yes, this course may be taken ______ times.

8. Will this course be repeated within the same semester?  
   - [ ] Yes  
   - [ ] No

9. Will this course be submitted to the Core Curriculum Council?  
   - [x] Yes  
   - [ ] No

10. How will this course be graded?  
    - [x] Grade  
    - [ ] S/U  
    - [ ] P/F (C2AD)

11. This course will be:
    - a. required for students enrolled in the following degree program(s) (e.g., B.A. in History)
    - B.Sc. in Materials Science and Engineering
    - b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in Geography)

12. [x] I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://wp.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

13. Prefix  
    - Course #  
    - Title (excluding punctuation)

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<th>Lect.</th>
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Approval recommended by:

[Signature]

Ibrahim Karaman  
Department Head or Program Chair (Type Name & Sign)  
Date: 12/15/2015

Chair, College Review Committee

Date:

Dean of College

Date:

Submitted to Coordinating Board by:

Chair, GC or UCC

Date:

Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845.8801 or sandra.williams@tamu.edu.
Curricular Services – 07/14
MSEN 250, Soft Matter  
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:  
Dr. Svetlana Sukhishvili, Reed McDonald Bldg. 221, svetlana@tamu.edu, 979-458-9840

Course (catalog) description: Structure, properties, and function of various classes of soft matter including colloids, polymers, amphiphils, liquid crystals, and biomacromolecules; basic concepts of viscoelasticity, glass transition, liquid-liquid and liquid-solid transitions and gelation; surface thermodynamics and surface tension; wetting and adhesion; forces acting between mesoscopic objects; supramolecular self-assembly in soft condensed matter.

Course Prerequisites: PHYS 208, CHEM 102, CHEM 112

Learning Outcomes: At the end of this course, students should be able to:
1. Identify main distinctive features of soft matter, including wide spectra of length scales and relaxation times;
2. Recognize how molecular structure and organization determine the properties of soft materials;
3. Explain how molecular entanglements affect materials’ viscoelastic properties;
4. Identify and quantify main forces acting between mesoscopic objects: Van der Waals and electrostatic interactions.
5. Appreciate the role of self-assembly of biological macromolecules;
6. Describe physical laws that define wetting and adhesion;
7. Give a quantitative description of cooperativity as a driving force in self-assembly.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1  Introduction to organic molecules, functional groups
Week 2-3 Chemical structures and bonding in organic molecules, surfactants, and biological molecules
Week 4  Dynamics, phase transitions and viscoelasticity in soft materials
Week 5  Polymer chain conformation and configuration polymer solutions and melts
Week 6  Glass transition; rubbers and gels
Week 7  Surfaces, interfaces and colloids: surface thermodynamics
Week 8  Surface tension, van der Waals forces
Week 9  Wetting and adhesion
Week 10  Electrostatic double layer, colloidal crystals
Week 11  Colloidal coagulation and stabilization, colloidal gels
Week 12  Micelles and liquid crystals
Week 13  Biological soft matter: electrostatics, hydration
Week 14  Biological soft matter: cooperativity and self-assembly

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Progress towards achieving learning outcomes will be evaluated through graded problem sets, midterm and final exam, and a literature assignment.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Problem sets: 20% {Weekly}
Midterm exams: 30% {Weeks 4 & 8}
Literature assignment: 10%
Final exam: 30% {End of semester}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

Form Instructions
1. Course request type: ☑ Undergraduate ☐ Graduate ☐ First Professional (DDE, M3, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
   MSEN 281, Materials Science and Engineering Seminar
3. Course prefix, number and complete title of course:

4. Catalog course description (not to exceed 50 words):
   Presenting technical advances in the field of materials science and engineering; applications toward solving engineering challenges; presentations from visiting industry and academic speakers, as well as faculty; introduction to current research themes and focal points in industry.

5. Prerequisite(s):

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<td>MSEN 201</td>
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Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course?
   - ☐ Yes
   - ☑ No
   If yes, from _______ to _______.

7. Is this a repeatable course?
   - ☐ Yes
   - ☑ No
   If yes, this course may be taken _______ times.
   Will this course be repeated within the same semester?
   - ☐ Yes
   - ☐ No

8. Will this course be submitted to the Core Curriculum Council?
   - ☐ Yes
   - ☑ No

9. How will this course be graded?
   - ☑ Grade
   - ☐ S/U
   - ☐ P/F (CLMD)

10. This course will be:
    a. required for students enrolled in the following degree program(s) (e.g., B.A in history)
       B.Sc. in Materials Science and Engineering
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

12. ☑ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpc.tamu.edu/resources/export-controls/export-control-basics-for-distance-education).

13. Prefix Course # Title (excluding punctuation)

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Approval recommended by:

Ibrahim Karaman 12/15/2015
Department Head or Program Chair (Type Name & Sign) Date

Chair, College Review Committee
Date

Dean of College
Date

Submitted to Coordinating Board by:

Chair, GC or UCC
Date

Associate Director, Curricular Services
Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8301 or sandra.williams@tamu.edu.
Curricular Services – 07/14
MSEN 281, Materials Science and Engineering Seminar  
Credits 1. 1 Lecture Hours  

Term: Fall 2017  

Meeting times and locations: TBD  

Instructor Information:  
Dr. Li Liu, Reed McDonald Bldg. 227, li.liu@tamu.edu, 979-458-1090  

Course (catalog) description: Seminar series presenting technical advances in the field of materials science and engineering and applications of this field towards solving engineering challenges; presentations from visiting industry and academic speakers, as well as faculty; introduction to current research themes and focal points in industry.  

Course Prerequisites: MSEN 201.  

Learning Outcomes: At the end of this course, students should be able to:  
1. Describe several recent technical breakthroughs, and the technologies they enable,  
2. Describe fundamental and applied materials research and development,  
3. Describe materials-focused activities pursued by industrial materials engineers,  
4. Identify areas of personal interest in the field of materials science and engineering.  

Textbook: None.  

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.  

Course Outline:  
Week 1-14  
Technical Seminars (speakers TBD)  
First Reflection due  
Second Reflection due  
Final Reflection (personal interest statement) due  

Course Policies and Procedures:  
Changes in schedule:  
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.  

Assessment and Evaluation:  
Understanding of recent technological breakthroughs will be evaluated by a series of three reflective pieces. The first two reflective pieces focus on relating the motivation, context, and results of a recent breakthrough. The
final piece focuses on identifying areas of interest to a student – this final piece will be utilized in pairing UG students with initial faculty advisors.

**Grading Scale (Standard Letter Scale):**
- A = 90-100
- B = 80-89.99
- C = 70-79.99
- D = 60-69.99
- F = ≤60

**Grading Policies:**
- First Reflection (30%)
- Second Reflection (30%)
- Final Reflection (20%)
- Final Exam (20%)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer's discretion.

**Late Work Policy:**
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3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
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i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)

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   a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
   b) Confirmation of visit to a health care professional affirming date and time of visit.

7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

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Form Instructions

1. Course request type:  ✔ Undergraduate  ☐ Graduate  ☐ First Professional (MD, JD, PharmD, DVM)

2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
   MSEN 301, Unified Materials Lab 1

3. Course prefix, number and complete title of course:

4. Catalog course description (not to exceed 50 words):
   Unified materials lab integrating materials synthesis, structural characterization, and property evaluation; theory and practice of experimental and simulation techniques; emphasis on relationship between processing parameters and resulting structures.

5. Prerequisite(s): MSEN 240 or registration therein, MSEN 310 or registration therein.

Cross-listed with:

Stacked with:

Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course?  ☐ Yes  ✔ No

   If yes, from _________ to _________

7. Is this a repeatable course?  ☐ Yes  ✔ No

   If yes, this course may be taken _________ times.

   Will this course be repeated within the same semester?  ☐ Yes  ☐ No

   Will this course be submitted to the Core Curriculum Council?  ☐ Yes  ✔ No

9. How will this course be graded?  ✔ Grade  ☐ S/U  ☐ Pass/Fail (P/F)

10. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
      B.Sc. in Materials Science and Engineering
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with those departments. Attach approval letters.

12. ✔ I certify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-control-basics-for-distance-education).

13. Prefix  Course #  Title (excluding punctuation)
    MSEN  301  UNIFIED MATLS LAB 1

    Lect.  Lab  Other  SCH  CIP and Fund Code  Admin. Unit  Acad. Year  FICE Code
    2.00  3.00  0.00  3.00  1418010006  1864  17 - 18  0 0 3 6 3 2

Approval recommended by:  Ibrahim Karaman

Department Head or Program Chair (Type Name & Sign)  Date  Chair, College Review Committee

Department Head or Program Chair (Type Name & Sign)  Date  Dean of College

(if cross-listed course)

Submitted to Coordinating Board by:  Chair, GC or UCC

Associate Director, Curricular Services  Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or swilliams@chem.tamu.edu
Curricular Services -- 07/14
MSEN 301, Unified Materials Lab I
writing intensive course
Credits 3. 2 Lecture Hours/3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Terry Creasy, Reed McDonald Bldg. 217, tcreasy@tamu.edu, 979-458-0118

Course (catalog) description: Unified materials lab integrating materials synthesis, structural characterization, and property evaluation; theory and practice of experimental and simulation techniques; emphasis on relationship between processing parameters and resulting materials structure.

Course Prerequisites: MSEN 240 or registration therein, MSEN 310 or registration therein.

Learning Outcomes: At the end of this course, students should be able to:
1. Demonstrate fundamental synthesis techniques of different classes of materials,
2. Demonstrate key materials characterization approaches,
3. Relate the strengths and weaknesses of experimental and simulation techniques,
4. Explain the theory of different synthesis, characterization, and simulation techniques,
5. Analyze and report experimental and simulation data, including basic statistical analysis and uncertainty quantification,
6. Effectively communicate technical results in formal lab report form.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:

Week 1, 2  Evolution of Metal Microstructures:
            Heat Treatment, Optical Microscopy, Grain Coarsening Prediction

Week 3, 4  Polymer Coatings
            Coating process & film morphology, Scanning Electron Microscopy

Week 5, 6  Composite Layup
            Anisotropy & Failure in Composites, Optical & Scanning Electron Microscopy

Week 7, 8  Sintering and Diffusion in Solid State Ceramics
            Sintering Process, X-Ray Diffraction, Diffusion Simulation

Week 9, 10 Thin Metal films
            Deposition of thin films, X-Ray Diffraction/Atomic Force Microscopy

Week 11, 12 Hydrogels
            Gelation process, FTIR Spectroscopy

Week 13, 14 Electrochemical Deposition
Solution-based Deposition of Coatings, Combined Microscopy/Diffraction Techniques

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Analysis and interpretation of technical data will be assessed through technical content of lab reports. Emphasis on understanding of underlying theory through required description of ‘methods’; emphasis on data analysis through presentation of ‘results’ in data and figure form; emphasis on interpretation through ‘discussion’ of results. This course is a formal w course. Thus, 1 crh (33.3 % of grade) will be based on form, content, style and grammar of written lab reports. Submission of lab reports will follow an iterative process to impart technical editing and revision skills.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Analysis and interpretation of technical data (66.6 %)
Form, content, style and grammar of written lab reports (33.3 %)

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07 .

Attendance:
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5. Religious holy day. NOTE: Prior notification is NOT required.
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      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
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Texas A&M University  
Departmental Request for a New Course  
Undergraduate • Graduate • Professional  
Submit original form and attach a course syllabus.

Form Instructions:
1. Course request type:  
   - Undergraduate [✓]  
   - Graduate  
   - First Professional (ODD, MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name):  
   Department of Materials Science and Engineering
3. Course prefix, number and complete title of course:  
   MSEN 302, Unified Materials Lab II
4. Catalog course description (not to exceed 50 words):
   Integrating materials synthesis, structural characterization, and property evaluation; theory and practice of experimental and simulation techniques; emphasis on relationship between materials structure and resulting materials physical properties.

5. Prerequisite(s):  
   MSEN 301  
   Cross-listed with:  
   Stacked with:  
   Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course?  
   - Yes  
   - No [✓]  
   If yes, from _______ to _______

7. Is this a repeatable course?  
   - Yes  
   - No [✓]  
   If yes, this course may be taken _______ times.
   Will this course be repeated within the same semester?  
   - Yes  
   - No [✓]

8. Will this course be submitted to the Core Curriculum Council?  
   - Yes  
   - No [✓]

9. How will this course be graded?  
   - Grade [✓]  
   - S/U  
   - P/F (CLAS)  

10. This course will be:  
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)  
      B.Sc. in Materials Science and Engineering
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

12. [✓] I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://www.tamu.edu/resources/export-controls/export-control-basics-for-distance-education).

13. Prefix  
    Course #  
    Title (excluding punctuation)  

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Approval recommended by:  
Ibrahim Karaman  
Department Head or Program Chair (Type Name & Sign)  
Date: 12/15/2015  
Chair, College Review Committee  

Department Head or Program Chair (Type Name & Sign)  
(if cross-listed course)  
Date:  
Dean of College  

Submitted to Coordinating Board by:  
Chair, GC or UCC  
Date:  
Effective Date  

Questions regarding this form should be directed to Sandra Williams at 845-0201 or sandra.williams@tamu.edu  
Curricular Services – 07/14
MSEN 302, Unified Materials Lab II
writing intensive course
Credits 3. 2 Lecture Hours/3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Terry Creasy, Reed McDonald Bldg. 217, tcreasy@tamu.edu, 979-458-0118

Course (catalog) description: Unified materials lab integrating materials synthesis, structural characterization, and property evaluation; theory and practice of experimental and simulation techniques; emphasis on relationship between materials structure and resulting materials physical properties.

Course Prerequisites: MSEN 301.

Learning Outcomes: At the end of this course, students should be able to:
1. Demonstrate fundamental synthesis techniques of different classes of materials,
2. Demonstrate key materials property characterization approaches,
3. Relate the strengths and weaknesses of experimental and simulation techniques,
4. Explain the theory of different synthesis, characterization, and simulation techniques,
5. Analyze and report experimental and simulation data, including basic statistical analysis and uncertainty quantification,
6. Effectively communicate technical results in formal lab report form.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:

Week 1, 2 Hardening of Metals

Heat Treatment, Plastic Deformation, Strengthening Mechanisms

Week 3, 4 Viscoelastic solids

Viscoelastic and viscoplastic properties

Week 5, 6 Fracture and failure of composite materials

Anisotropy & Failure in Composites

Week 7, 8 Dielectric Oxides

Processing of capacitors, capacitor breakdown

Week 9, 10 Corrosion of Metals

Electrochemical testing

Week 11, 12 Thermal Insulators and Conductors

Characterization of thermal transport

Week 13, 14 Magnetic thin films
Electronic and magnetic properties of thin films

Course Policies and Procedures:
Changes in schedule:
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Assessment and Evaluation:
Analysis and interpretation of technical data will be assessed through technical content of lab reports. Emphasis on understanding of underlying theory through required description of 'methods'; emphasis on data analysis through presentation of 'results' in data and figure form; emphasis on interpretation through 'discussion' of results. This course is a formal w course. Thus, 1 crh (33.3 % of grade) will be based on form, content, style and grammar of written lab reports. Submission of lab reports will follow an iterative process to impart technical editing and revision skills.

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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

Form Instructions
1. Course request type: ☑ Undergraduate ☐ Graduate ☐ First Professional (D.D.S., M.D., J.D., Pharm.D., D.V.M.)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
3. Course prefix, number and complete title of course: MSEN 320, Deformation and Failure Mechanisms in Engineering Materials
4. Catalog course description (not to exceed 50 words):
Survey of deformation and failure mechanisms in different materials, including metals, ceramics, polymers, and composites; effect of atomic structure, defects and microstructure on deformation and failure; deformation and failure mechanism maps and effects of temperature and deformation rate.

5. Prerequisite(s):
MSEN 310, or approval of instructor
Cross-listed with: Stacked with:
Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course? ☐ Yes ☑ No If yes, from _____ to _____
7. Is this a repeatable course? ☐ Yes ☑ No If yes, this course may be taken _____ times.
Will this course be repeated within the same semester? ☐ Yes ☑ No
Will this course be submitted to the Core Curriculum Council? ☐ Yes ☑ No
8. How will this course be graded: ☑ Grade ☐ S/U ☐ P/F (CLMD)
9. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
      B.Sc. in Materials Science and Engineering
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

10. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.
11. ☑ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://post.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education)

12. Prof: Courses # Title (excluding punctuation)

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Approval recommended by:

Ibrahim Karaman [Signature] 2/15/2015
Department Head or Program Chair (Type Name & Sign) Date

[Signature] 2/15/2015
Chair, College Review Committee Date

[Signature] 2/15/2015
Dean of College Date

[Signature] Date
Submitted to Coordinating Board by:

[Signature] Date
Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services - 07/14
MSEN 320, Deformation and Failure Mechanisms in Engineering Materials  
Credits 3. 3 Lecture Hours

Term: Fall 2017  
Meeting times and locations: TBD

Instructor Information:  
Dr. Alan Needleman, Reed McDonald Bldg. 228, needle@tamu.edu, 979.862.2021

Course (catalog) description: Survey of deformation and failure mechanisms in different materials, including metals, ceramics, polymers, and composites; effect of atomistic structure, defects and microstructure on deformation and failure; deformation and failure mechanism maps and effects of temperature and deformation rate.

Course Prerequisites: MSEN 310, or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
1. Understand underlying atomistic mechanisms of deformation and failure in different materials, namely metals, ceramics, polymers and composites;
2. Identify deformation and failure mechanism in different materials;
3. Select appropriate strengthening and toughening strategies in different materials systems;
4. Predict a lifetime of structural components based on their dominant deformation and failure mechanisms;
5. Carry out failure analysis and determine origin of failure in structural components;

Textbook:  

Additional Material:  
N.E. Dowling, Mechanical Behavior of Materials, Prentice Hall, 1999

Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:  
Week 1 Introduction: Concept and mathematical description of stresses and strains;  
Week 2 Overview of Macroscopic mechanical behavior of materials; Stress-strain curves and constitutive relationships;  
Week 3 Elastic deformation - Atomistic aspects and constitutive models;  
Week 4 Plastic deformation mechanisms: dislocation based mechanisms;  
Week 5 Plastic deformation mechanisms: twinning and kinking, diffusion based mechanisms, grain boundary sliding;
Week 6  Mid-semester exam; Diffusionless phase transformations;
Week 7  Time dependent deformation mechanisms: visco-elastic, visco-plastic and creep deformation;
Week 8  Strengthening mechanisms; Ashby deformation maps and effect of temperature, strain rate and microstructure on deformation mechanisms and mechanical behavior;
Week 9  Introduction to fracture mechanics; Mechanisms of crack initiation and propagation;
Week 10 Brittle and Ductile failure mechanisms;
Week 11 Fatigue - Deformation and failure mechanisms in cyclic loading conditions
Week 12 Overview of experimental method for mechanical characterization of failure in engineering materials; Fractography;
Week 13 Toughening mechanisms; Fracture mechanisms maps and life prediction methods;
Week 14 Project presentations

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Progress towards achieving learning outcomes will be evaluated through homework, exams, and final project. Peer review will be incorporated into the evaluation of final project reports and presentations.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Mid-semester exam (25%) {Week 6}
Final Exam (25%) {Week 15}
Project presentation and report (20%) {Week 14}
Homework assignments (30%) {Weekly}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer's discretion.

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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
Submit original form and attach a course syllabus.

Form Instructions
1. Course request type:  ☑ Undergraduate  ☐ Graduate  ☐ First Professional (ESRD, MD, JD, PharmD, DPharm)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
3. Course prefix, number and complete title of course: MSEN 330, Numerical Methods for Materials Scientists and Engineers
4. Catalog course description (not to exceed 50 words):
   Computing platforms to address scientific/engineering problems related to materials science and engineering; analyze data; implement mathematical models of materials behavior; numerical methods to solve materials-related problems.

5. Prerequisite(s): MSEN 230

6. Is this a variable credit course? ☑ No

7. Is this a repeatable course? ☑ No

8. Will this course be repeated within the same semester? ☑ Yes  ☐ No

9. Will this course be submitted to the Core Curriculum Council? ☑ Yes  ☐ No

10. How will this course be graded? ☑ Grade  ☐ S/U  ☐ P/F (CLAAD)

   This course will be:
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Prefix  Course #  Title (excluding punctuation)
MSEN  330  NUMERICAL METHODS MATLS

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Approval recommended by:

Ibrahim Karaman
Department Head or Program Chair (Type Name & Sign) Date 12/15/2015

Chair, College Review Committee

Department Head or Program Chair (Type Name & Sign) Date
(if cross-listed course)

Dean of College

Submitted to Coordinating Board by:

Chair, GC or UCC

Date

Associate Director, Curricular Services

Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu
Curricular Services – 07/14

Received 12/16/2015
MSEN 330, Numerical Methods for Materials Scientists and Engineers
Credits 3. 2 Lecture Hours, 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Xiaofeng Qian, Reed McDonald Bldg. 226, feng@tamu.edu, 979-458-9843

Course (catalog) description: The purpose of this course is to introduce students to the use of computing platforms to address scientific/engineering problems related to materials science and engineering. Emphasis will be placed on the use of computer programming to: analyze data, implement mathematical models of materials behavior, the use of numerical methods to solve materials-related problems.

Course Prerequisites: MSEN 230

Learning Outcomes: At the end of this course, students should be able to:

1. Use general scientific programming approaches to accelerate the analysis of materials data and to solve mathematical problems representing materials properties and phenomena.
2. Use numerical methods for the solution of non-linear equations associated with physical models of materials behavior.
3. Use numerical linear algebra to describe anisotropic properties of materials and to perform linear transformations.
4. Use least-squares methods for the parameterization of models with experimental data.
5. Use numerical differentiation and integration to quantify rates of change and cumulative changes in materials response.
6. Use numerical methods for the solution of ODEs/PDEs representing dynamic behavior in materials systems.
7. Use numerical optimization techniques for materials discovery and design.


Additional Material: Lecture notes, specific codes and subroutines, assignments, solutions, grades, project instructions, and additional material will be provided in the class or will be made available at http://ecampus.tamu.edu.

Course Outline:
Weeks 1-2  Introduction to Programming
Weeks 3-4  Solution to Non-linear Equations: Application to Constitutive Models of Materials Behavior
Weeks 5-6  Linear Algebra and Linear Transformations of Materials Anisotropic Properties
Week 7    Building models from data through least squares approaches
Weeks 8-9  Numerical integration and differentiation of materials response.
Weeks 10-11 Numerical solution to ODEs: reaction kinetics, dynamics of atoms in a crystal
Week 12    Numerical solution to PDEs: the diffusion equation in 1 D
Weeks 13-14  Constrained Optimization: From Gibbs Energies to Phase Diagrams

Course Policies and Procedures:

Changes in schedule: The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation: Proper understanding of the Numerical Methods commonly used by Materials Scientists and Engineers will be evaluated through projects and exams. The focus will be on the ability to solve a given problem using computer programming.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
In-Class Participation and quizzes (10 %)
Weekly Projects (60%)
Exam #1 (15%) {Week 7}
Exam #2 (15%) {Week 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy: No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance: The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell-phones and other electronic distractions.

Make-up Policy: If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
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      from his or her medical provider within one week of the last date of the absence (see Student
      Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at
      instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available
         at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
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    treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and
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    medically necessary by the student's physician. Requests for excused absence related to pregnancy
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prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or
after the absence, but not later than two working days after the absence.

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civil rights protection for persons with disabilities. Among other things, this legislation requires that all students
with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their
disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services,
currently located in the Disability Services building at the Student Services at White Creek complex on west
campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University

Departmental Request for a New Course
Undergraduate + Graduate + Professional

Submit original form and attach a course syllabus.

Form Instructions
1. Course request type:  
   - [ ] Undergraduate  
   - [ ] Graduate  
   - [ ] First Professional (DDS, MD, JD, PharmD, DVM)

2. Request submitted by (Department or Program Name):  
   Department of Materials Science and Engineering

3. Course prefix, number and complete title of course:  
   MSEN 340, Case Studies in Materials

4. Catalog course description (not to exceed 50 words):  
   Case studies illustrating materials failure and consequences thereof; materials selection process in the face of uncertainty; industry standards and regulatory frameworks; design tradeoffs and cost analysis; ethical and business implications of materials failure.

5. Prerequisite(s):  
   MSEN 310

6. Is this a variable credit course?  
   - [ ] Yes  
   - [x] No  
   If yes, from _______ to _______

7. Is this a repeatable course?  
   - [ ] Yes  
   - [x] No  
   If yes, this course may be taken _______ times.

Will this course be repeated within the same semester?  
   - [ ] Yes  
   - [ ] No

8. Will this course be submitted to the Core Curriculum Council?  
   - [ ] Yes  
   - [x] No

9. How will this course be graded?  
   - [x] Grade  
   - [ ] S/U  
   - [ ] P/F (CLMD)

10. This course will be:  
    a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)  
    B.Sc. in Materials Science and Engineering
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

11. I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

12. Prefix, Course #, Title (excluding punctuation):

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| Approval recommended by:  
   Ibrahim Karaman  
   Department Head or Program Chair (Type Name & Sign)  
   12/15/2015

Chair, College Review Committee  
Date

Department Head or Program Chair (Type Name & Sign)  
Date

Dean of College  
Date

Submitted to Coordinating Board by:

Chair, GC or UCC  
Date

Associate Director, Curricular Services  
Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services – 07/14
MSEN 340, Case Studies in Materials  
Credits 2. 2 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information: Dr. Patrick Shamberger  
Reed McDonald Bldg. 229, patrick.shamberger@tamu.edu, 979-458-1086

Course (catalog) description: Case studies illustrating materials science and engineering practice; systems analysis of repercussions for business and society; root causes of success and failure; design in the face of uncertainty; industry standards and regulatory frameworks; tradeoffs and cost-benefit analysis; ethical implications of engineering practice.

Course Prerequisites: MSEN 310

Learning Outcomes: At the end of this course, students should be able to:
1. Demonstrate critical thinking skills required in engineering practice through analysis of real-world examples
2. Illustrate trade-offs and system-level thinking with cases of both exemplary and poor materials selection or design
3. Show awareness of the role that materials scientists and engineers play in industry and the possible effect on society
4. Describe best practices in materials science and engineering in the face of uncertainty,
5. Introduce industry standards and regulatory frameworks,

Textbook:

Additional Material:  
Additional materials for specific cases will be distributed by the instructor. Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at [http://ecampus.tamu.edu](http://ecampus.tamu.edu).

Course Outline:
*Week 1*  
Case study 1: DH 106 Comet

*Week 2*  
Introduction to engineering ethics; business implications of engineering design

*Week 3*  
Case study 2: recycling and resource management
Week 4  Introduction to systems engineering and uncertainty
Week 5-6  Exam 1; Teaming and assignment of final project topics
Week 7  Case 3: turbine disk failure in United Airlines Flight 232
Week 8  Introduction to engineering forensics
Week 9  Site visit and/or presentations by faculty of practice
Week 10  Case 4: the nuclear fuel cycle
Week 11  Introduction to regulatory frameworks
Week 12  Exam 2; special topic
Week 13-14  Final project presentations

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Effective communication techniques will be evaluated through exams, and a written term project.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Exam #1 (20 %) {Week 5}
Exam #2 (20 %) {Week 12}
Term Project (60%) {End of semester}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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Make-up Policy:
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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
Submit original form and attach a course syllabus.

Form Instructions

3. Course request type:  ☑ Undergraduate  □ Graduate  □ First Professional (DVM, MD, JD, PharmD, DPM)

2. Request submitted by (Department or Program Name):
Department of Materials Science and Engineering

3. Course prefix, number and complete title of course:
MSEN 370, Introduction to Computational Materials Science and Engineering

4. Catalog course description (not to exceed 50 words):
Studio course introducing methods to simulate materials behavior across multiple scales; topics include electronic structure calculations, classical molecular dynamics, computational thermodynamics and kinetics of materials, microstructure evolution, simulation, continuum models of materials behavior.

5. Prerequisite(s):
MSEN 210, MSEN 330

Cross-listed with:  
Stacked with:  
Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course?  ☑ Yes  □ No  If yes, from _______ to _______

7. Is this a repeatable course?  ☑ Yes  □ No  If yes, this course may be taken _______ times.

8. Will this course be repeated within the same semester?  ☑ Yes  □ No

9. Will this course be submitted to the Core Curriculum Council?  ☑ Yes  □ No

10. How will this course be graded?  ☑ Grade  □ S/U  □ P/F (CLSC)

10. This course will be:
a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
B.Sc. in Materials Science and Engineering
b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

12. I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamuno.edu/resources/export-controls/export-control-basics-for-distance-education).

13. Prefix  Course #  Title (excluding punctuation)
MSEN  370  HYDRO COMPUTATIONAL MATLS SCI ENG

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</table>

Approval recommended by:

Ibrahun Karaman
Department Head or Program Chair (Type Name & Sign)  12/15/2015
Date

Chair, College Review Committee
Date

Dean of College
Date

Submitted to Coordinating Board by:
Chair, GC or UCC
Date

Associate Director, Curricular Services
Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu
Curricular Services – 07/14

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CURRICULAR SERVICES

RECEIVED
DEC 2 1 2015
MSEN 370, Introduction to Computational Materials Science and Engineering
Credits 3. 2 Lecture Hours, 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Ankit Srivastava, Reed McDonald Bldg. 223, ankit.sri@tamu.edu, 979.458.9841

Course (catalog) description: Studio course introducing methods to simulate materials behavior across multiple scales; topics include: electronic structure calculations, classical molecular dynamics, computational thermodynamics and kinetics of materials, microstructure evolution simulation, continuum models of materials behavior.

Course Prerequisites: MSEN 210, MSEN 330

Learning Outcomes: At the end of this course, students should be able to:
1. Recognize the strengths and limitations associated with different computational materials modeling methods
2. Understand the basic structure of most materials simulation codes in terms of input(s), problem representation, simulation parameters and output(s)
3. Use basic functionality of electronic structure codes to calculate physical properties of model materials systems
4. Use classical molecular dynamics to simulate dynamic behavior of collections of atoms
5. Use computational thermodynamics software to calculate phase stability in multi-component systems
6. Use computational kinetics software to quantify rates of transformation in materials
7. Use microstructure evolution software to simulate simple phase transformations


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1  Using Models to Represent Reality
Week 2  The basic Ingredients of Materials Simulation: Inputs, Problem Representation, Simulation Parameters and Outputs.
Week 3  Basics of Electronic Structure Simulations: Density Functional Theory in a Nutshell
Week 4  Using VASP/ABINIT to Calculate Equations of State of Simple Crystals
Week 5  Molecular Dynamics: Applying F=ma at the atomic scale
Week 6  Using LAMMPS to Simulate Melting of a Polymer
Week 7  Computational Thermodynamics: Minimizing Gibbs Energies
Week 8  Using Thermo-Calc to calculate the phase diagram in multi-component Ceramic System
Week 9  Computational Kinetics: Connecting Diffusion to Phase Transformations
Week 10 Using DICTRA to simulate the motion of an fcc/bcc interface in stainless steels
Week 11 Microstructure Evolution Simulations: The Phase Field Method
Week 12 Using FiPy to Simulate Spinodal Decomposition in a Bio-material
Week 13 Challenges and Opportunities in Computational Materials Science
Week 14 Multi-scale Computational Materials Science: Bridging Scales

Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course will be evaluated through quizzes and projects.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Quizzes: 20%
Project 1: 20% \{Week 4\}
Project 2: 25% \{Week 8\}
Project 3: 35% \{Week 14\}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

Attendance:
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8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
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Currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
Submit original form and attach a course syllabus.

Form Instructions

1. Course request type: ☑ Undergraduate  ☐ Graduate  ☐ First Professional (DDS, MD, JD, PharmD, DPhil)

2. Request submitted by (Department or Program Name):
   Department of Materials Science and Engineering

3. Course prefix, number and complete title of course:
   MSEN 400, Design and Analysis of Material Experiments

4. Catalog course description (not to exceed 50 words):
   Systematic design of experimental investigations, lead team, identify topics in consultation with the instructor and develop experiment designs including establishing the need, associated requirements and objective; conduct experiments; characterize materials; analyze and interpret results; documenting the procedures, analysis, results, and conclusions; present written and oral reports.

5. Prerequisite(s):
   MSEN 220, MSEN 302, MSEN 320

6. Is this a variable credit course? ☐ Yes  ☑ No
   If yes, from ______ to _______.

7. Is this a repeatable course? ☐ Yes  ☑ No
   If yes, this course may be taken ______ times.

8. Will this course be repeated within the same semester? ☐ Yes  ☑ No

9. Will this course be submitted to the Core Curriculum Council? ☑ Yes  ☐ No

10. How will this course be graded? ☑ Grade  ☐ S/U  ☐ Pass/Fail (CLAS)

11. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
      B.Sc. in Materials Science and Engineering
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

12. I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://www.tamu.edu/resources/export-control/export-controls-basics-for-distance-education).

13. Prefix  Course #  Title (excluding punctuation)
    MSEN  400  DESIGN ANALYSIS MATERL EXPMNTS

    | Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | PACE Code |
    |-------|-----|-------|-----|-------------------|-------------|------------|-----------|
    | 2.00  | 3.00| 0.00  | 3.00| 1418010006        | 1864        | 17         | 18        | 0  0  3  6  3  2 |

Approval recommended by:

Ibrahim Karaman
Department Head or Program Chair (Type Name & Sign)
Date 12/15/2015

Chair, College Review Committee
Date

Dean of College
Date

Submitted to Coordinating Board by:

Chair, GC or UGC
Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services – 07/14
MSEN 400, Design and Analysis of Materials Experiments
Credits 3. 2 Lecture Hours/3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. K. T. Hartwig, Reed McDonald Bldg. 220, thattwig@tamu.edu, 979-845-1585

Course (catalog) description: Systematic design of experimental investigations; student teams identify topics in consultation with the instructor and develop experiment designs including establishing the need, associated requirements and objective; conduct experiments; characterize materials; analyze and interpret results; documenting the procedures, analysis, results, and conclusions; present written and oral reports.

Course Prerequisites: MSEN 220, MSEN 302, and MSEN 320

Learning Outcomes: At the end of this course, students should be able to:
1. Establish the justification for an experiment, that is, why are the results needed or desired?
2. Establish specific objectives of an experiment.
3. Establish the budgetary, manpower and time requirements, including time sequencing of the project, and schedule for a project.
4. Establish the primary variables that must be controlled and measured by applying engineering fundamentals to determine the theory that describes the phenomena under investigation.
5. Identify clearly what the response variables (dependent variables) are and what the controlled variables (independent variables) are for a particular experiment.
6. Determine specific tasks (functions) that must be completed to conduct the experiment.
7. Determine if a Standard or Recommended Practice exists for conducting the experiment.
8. Determine the uncertainty (confidence intervals) which may be required for the primary measurements, and the number and spacing of such measurements required for proper data analysis and presentation of results.
9. Identify extraneous variables that might influence the results of an experiment and how they may be suppressed.
10. Determine whether measurements should be taken randomly or sequentially and design a test plan.
11. Determine if a factorial or fractional factorial experiment design can or should be used and design one if needed.
12. Set up data reduction calculations before conducting the experiment to be sure that adequate useful data will be collected to meet the objectives of the experiment.
13. Analyze the possible uncertainty in the anticipated results before an experiment is conducted so that modifications in uncertainty requirements on the various measurements may be changed if necessary.
14. Select instrumentation for the various material characterizations and measurements to match the anticipated uncertainty requirements. Modify the instrumentation to match budgetary, performance, and schedule limitations if necessary.
15. Conduct a preliminary analysis after collecting a few data points to make sure that the experiment is progressing as planned, and modify the experimental apparatus and/or procedure in accordance with the preliminary findings.
16. Conduct an experiment by doing materials characterizations and taking the experimental data, and presenting the results in a manner such that they can be analyzed and interpreted relevant to the objective of the experiment.
17. Test experimental results for consistency and rejection or outliers.
18. Apply statistical analysis to the results such as analysis of variance (ANOVA) or multiple regression analysis to aid in interpreting the results and determining their significance.
19. Discuss the results of an experiment relative to the objectives to: interpret the results; explain any discrepancies, scatter of data, or anomalies in the results; point out most important results; and provide a lead in to the conclusions
of the experiment.
20. Summarize findings of an experiment, draw conclusions, and make recommendations.
21. Organize and prepare a report describing the justification, objectives, experimental setup and procedures, findings, results, and conclusions of an experiment in writing and orally.

Textbook:

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1: Introduction to course and the general experimental design process, relationship to general design process.
Week 2: General planning of experimental investigations, establishing project objectives, application of systems engineering design process to experiments, identifying types of experiments, standards and recommended practices, identifying and organizing tasks, and preparing an experiment project proposal.
Week 3: Use of uncertainty analysis in the planning of experiments, statistical analysis for experiments, relationship of number of significant figures reported and uncertainty, confidence intervals, data acquisition and data checking.
Week 4: Preparing written reports of experiments, format for general report, difference between findings and conclusions.
Week 5: Continuation of interpretation, presentations and reporting of results, reports in industry.
Week 6: Detailed design of experimental investigations; determination of number and spacing of data points.
Week 7: Detailed design of experimental investigations; test sequences and experimental plans.
Week 8: Detailed design of experimental investigations; random designs, suppression of extraneous variables.
Week 9: Detailed design of experimental investigations; mathematical modeling of experimental results.
Week 10: Introduction to statistical Design of Experiments (DOE)-factorial design
Week 11: Fractional Factorial Design of Experiments, oral presentations.
Week 12: Analysis of variance (ANOVA) for single, two and three factor experiments.
Week 13: Multiple regression analysis.
Week 14: Student presentations

Class/laboratory Schedule: Two 50 minute lectures per week plus one 3 hour lab session per week where students work in teams of 3 or 4.

Relationships Between ABET and Course Program Outcomes:

<table>
<thead>
<tr>
<th>ABET Program Outcome</th>
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<tbody>
<tr>
<td>a. ability to apply knowledge of mathematics, science and engineering</td>
<td>f. understanding of professional and ethical responsibility</td>
</tr>
<tr>
<td>b. ability to design and construct experiments, and analyze and interpret data</td>
<td>g. ability to communicate effectively</td>
</tr>
<tr>
<td>c. ability to design a system, component, or process to meet desired needs within realistic constraints</td>
<td>h. education to understand the impact of engineering solutions in a global, economic, environmental, and societal context</td>
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<tr>
<td>d. ability to function on multi-disciplinary teams</td>
<td>i. recognition of the need for, and an ability to engage in life-long learning</td>
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<tr>
<td>e. ability to identify, formulate and solve engineering problems</td>
<td>j. a knowledge of contemporary issues</td>
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<td></td>
<td>k. ability to use the techniques, skills and modern engineering tools necessary for engineering practice</td>
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</tbody>
</table>
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Understanding of fundamental concepts of Materials Science and Engineering will be evaluated through two in-class exams, and through a final group term paper relating design and engineering of material properties for specific technological applications.

Student understanding will be assessed throughout class in the form of quizzes, HWs, and in-class group activities, to ascertain that students are meeting desired learning outcomes.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grade Components:

Two Written Proposals (team) 25%
Two Written Reports (team) 25%
Final Oral Report (team) 10%
Quizzes (individual) 10%
Lab Performance (individual) 10%
Final Exam (individual) 20%

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell-phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.
The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07 ). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

Academic Integrity:
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

Americans with Disabilities Act (ADA) Policy Statement:
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
Submit original form and attach a course syllabus.

Form Instructions:
1. Course request type: ☑ Undergraduate □ Graduate □ First Professional (DDS, MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
3. Course prefix, number and complete title of course: MSEN 401, Materials Research and Design

4. Catalog course description (not to exceed 50 words):
   The research and design process; need definition, functional analysis, performance requirements, evaluation criteria. Conceptual design evaluation; introduction to systems engineering; parametric and risk analysis, failure analysis, material selection, and manufacturability; cost and life cycle issues, project management; topics will come from sponsored research or an Industry-sponsored design project.

5. Prerequisite(s):
   MSEN 281, MSEN 340, MSEN 400
   Cross-listed with:
   Stacked with:

6. Is this a variable credit course? No If yes, from ______ to ______

7. Is this a repeatable course? No If yes, this course may be taken ______ times.

8. Will this course be submitted to the Core Curriculum Council? No

9. How will this course be graded: ☑ Grade □ S/U □ P/F (CLM)

10. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in History)
   B.Sc. in Materials Science and Engineering
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

12. ☑ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://oer.tamu.edu/teams/ces/export- controls/export-control-basics-for-distance-education).

13. Prefix Course # Title (excluding punctuation)

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Approval recommended by:

Ibrahim Karaman
Department Head or Program Chair (Type Name & Sign) 12/15/2015
Date
Chair, College Review Committee
Date

Department Head or Program Chair (Type Name & Sign) Date
(if cross-listed course)

Submitted to Coordinating Board by:

Chair, GC or UCC Date

Associate Director, Curricular Services Date

Questions regarding this form should be directed to Sandra Williams at 845-2011 or sandra.williams@tamu.edu
Curricular Services – 07/14
MSEN 401 Materials Research and Design I
Credits 3. 2 Lecture Hours/3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Ramesh Talreja, HRBB 736A, talreja@tamu.edu, 979.458.3256

Course (catalog) description: The research and design process; need definition, functional analysis, performance requirements, evaluation criteria, conceptual design evaluation; introduction to systems engineering; parametric and risk analysis, failure analysis, material selection, and manufacturability; cost and life cycle issues, project management; topics will come from sponsored research or an industry-sponsored design project.

Course Prerequisites: MSEN 281, MSEN 340, MSEN 400

Learning Outcomes: At the end of this course, students should be able to:
1. Recognize the stages of a generalized design process; explain what activities occur during each stage; distinguish among the products of each stage.
2. Apply the early stages of a generalized design process.
3. Analyze client/sponsor requests in order to identify quantitative design requirements.
4. Identify sources of information and differentiate among them to determine which are useful.
5. Develop a function structure by abstraction based on design requirements.
6. Apply innovation methods to generate conceptual design solutions.
7. Determine whether you have encountered fixation during concept generation and apply corrective action if necessary.
8. Describe the differences among concept sources such as database-driven, computational/modeling, or analytical-driven approaches
9. Evaluate concepts and select the most viable.
10. Recognize the triple constraint (cost, time, performance) and its effects on project management.
11. Produce a suitable work breakdown structure for accomplishing a design task.
12. Assess risk in a project and assign appropriate contingency.
13. Employ software tools to manage projects.
14. Develop a personal approach for successfully participating on a design team.
15. Record all project-related developments in a design project notebook.
16. Communicate the results of a design orally and in writing.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.
**Course Outline:**
Week 1: Introduction to design and project management
Week 2: Creating a Work Breakdown Structure, effective team participation
Week 3: Using project management software, functional representation of needs
Week 4: Methods of tracking project status, abstracting and producing a function structure
Week 5: Revising function structures and obtaining customer agreement
Week 6: Introduction of cognitive perspective of innovative behavior
Week 7: Using intuitive innovation methods
Week 8: Using logical innovation methods
Week 9: Applying innovation within an entrepreneurial activity, introduction of intellectual property
Week 10: Evaluating design concepts and selection methods
Week 11: Identifying information sources, making informed design decisions
Week 12: Embodying selected design concepts
Week 13: Communicating design information
Week 14: Presenting detailed conceptual designs to customers

**CLASS/LABORATORY SCHEDULE:** Two, 50 minute lecture sessions per week that overview engineering design principles. Studio sessions meet once per week outside of lecture to work on project teams focused on a specific research project, interdisciplinary senior design activity in coordination with another engineering department, or an industry-sponsored design project.

**Course Policies and Procedures:**

*Changes in schedule:*
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

*Assessment and Evaluation:*
Understanding of fundamental concepts of Materials Science and Engineering will be evaluated through two in-class exams, and through a final group term paper relating design and engineering of material properties for specific technological applications.

Student understanding will be assessed throughout class in the form of quizzes, HWs, and in-class group activities, to ascertain that students are meeting desired learning outcomes.

**Grading Scale (Standard Letter Scale):**
A = 90-100; B = 80-89.99; C = 70-79.99; D = 60-69.99; F = <60

**Grading Components:**
- Home Work 10%
- Quizzes 10%
- Exam 20%
- Final Presentation 20%
- Final Design Report 30%
- Performance on Team 10%

**Late Work Policy:**
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).
**Attendance:**
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3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
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      a) Texas A&M University Explanatory Statement for Absence from Class form available at [http://attendance.tamu.edu](http://attendance.tamu.edu) or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.
Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

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Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: [http://aggiehonor.tamu.edu](http://aggiehonor.tamu.edu).

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The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit [http://disability.tamu.edu](http://disability.tamu.edu).
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

From Instructions
1. Course request type: ☑ Undergraduate ☐ Graduate ☐ First Professional (EDS, MD, JD, PharmD, IVM)
2. Request submitted by (Department or Program Name):
   Department of Materials Science and Engineering
3. Course prefix, number and complete title of course:
   MSEN 402, Materials Research and Design II
4. Catalog course description (not to exceed 50 words):
   Continuation of MSEN 401; development of innovative solutions to research or industry-provided design challenges;
   structured framework and methodology for design activities; innovation, computational materials science,
   synthesis/processing, and analysis/characterization of material components; project definition, management,
   customer interaction and effective team participation; presentations and design reviews.

5. Prerequisite(s):
   MSEN 401
   Cross-listed with: 
   Stacked with:
   Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course? ☑ Yes ☐ No
   If yes, from _____ to _____

7. Is this a repeatable course? ☑ Yes ☐ No
   If yes, this course may be taken _____ times.
   Will this course be repeated within the same semester? ☑ Yes ☐ No

8. Will this course be submitted to the Core Curriculum Council? ☑ Yes ☐ No

9. How will this course be graded: ☑ Grade ☐ S/U ☐ P/F (CLWD)

10. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in History)
      B.S. in Materials Science and Engineering
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in Geography)

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

12. ☑ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/thesources/export-controlbasics-for-distance-education).

13. Prefix Course # Title (excluding punctuation)

<table>
<thead>
<tr>
<th>Lect.</th>
<th>Lab</th>
<th>Other</th>
<th>SCH</th>
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<th>Acad. Year</th>
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   Approval recommended by:
   Ibrahim Karaman
   Department Head or Program Chair (Type Name & Sign) Date Chair, College Review Committee Date
   (If cross-listed course)
   Department Head or Program Chair (Type Name & Sign) Date Dean of College Date

   Submitted to Coordinating Board by:
   Chair, GC or UCC Date
   Associate Director, Curricular Services Date

Questions regarding this form should be directed to Sandra Williams at 845-8200 or sandra.williams@tamu.edu.
Curricular Services – 07/14
MSEN 402 Materials Research and Design II
Credits 3. 2 Lecture Hours/3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Ramesh Talreja, HRBB 736A, talreja@tamu.edu, 979.458.3256

Course (catalog) description: Continuation of MSEN 401; development of innovative solutions to research or industry-provided design challenges; structured framework and methodology for design activities; innovation, computational materials science, synthesis/processing, and analysis/characterization of material components; project definition, management, customer interaction and effective team participation; presentations and design reviews.

Extended description: In this second capstone design course, in which the engineering design and development process from need definition to embodiment, and the development of innovative solutions to real-world, and research or industry-provided design challenges will be addressed. A structured framework and methodology for design activities is emphasized and practiced through its application to challenging design tasks that are addressed by small design teams in complementary design studios. The design activity includes innovation, computational materials science, synthesis/processing, and analysis/characterization of material components, as well as project definition, management, customer interaction and effective team participation. Exposure to these topics occurs through participation in an intensive client-sponsored design project. Presentations and design reviews are conducted with technical staff from the partner-sponsor, and formal reports are prepared and submitted as evidence of participation and demonstration of hands-on design skills developed.

Course Prerequisites: MSEN 401

Learning Outcomes: Students who successfully complete this course should be able to design a material system, component or process to meet desired performance requirements within realistic constraints that include economic, social, political, environmental, ethical, health and safety, as well as manufacturability and sustainability. At the end of this course, you should be able to:
1. Comprehend the product design and development process, and the engineer's role.
2. Define all environmental factors that may affect the material/component.
3. Select suitable material configurations and manufacturing processes.
4. Select theories of failure and failure modes from environmental conditions.
5. Select preliminary design margins by performing adequate risk analyses.
6. Develop final material requirements from design margins for each failure mode.
7. Define final material properties for all conceivable circumstances.
8. Perform computation based materials modeling and analyses.
9. Select developmental models, processes and procedures to evaluate material failure modes.
10. Define the new product (process) by converting functional properties into performance properties, and prepare final product (synthesis/processing) protocols.
11. Prepare final product design report and present final product presentation to sponsor.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Topics:
- Engineering Design Overview
- Design Principles
- Design Optimization
- Materials Selection and Processing
- Computation and Modeling
- Design for Manufacturing, for Assembly, and for Inspection
- Product Liability
- Failure Mode and Effects Analysis (FMEA)
- Risk Assessment, Risk Analysis, and Risk Management
- Total Quality Management
- Life-Cycle Cost Analysis and sustainability
- Patents and Intellectual Property

CLASS/LABORATORY SCHEDULE: Two lecture sessions per week that overview engineering design principles, plus a studio session that meets once per week for work on project teams devoted to a specific research or industry-sponsored design project.

Relationship of MSEN 402 course to ABET program outcomes:

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<thead>
<tr>
<th>ABET Program Outcome</th>
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<tr>
<td>x a. ability to apply knowledge of mathematics, science and engineering</td>
<td>x f. understanding of professional and ethical responsibility</td>
</tr>
<tr>
<td>b. ability to design and construct experiments, and analyze and</td>
<td>x g. ability to communicate effectively</td>
</tr>
<tr>
<td>x c. ability to design a system, component, or process to meet desired needs within</td>
<td>x h. education to understand the impact of engineering solutions in a global, economic, environmental, and societal context</td>
</tr>
<tr>
<td>x d. ability to function on multi-disciplinary teams</td>
<td>x i. recognition of the need for, and an ability to engage in lifelong learning</td>
</tr>
<tr>
<td>x e. ability to identify, formulate and solve engineering problems</td>
<td>x j. a knowledge of contemporary issues</td>
</tr>
<tr>
<td></td>
<td>x k. ability to use the techniques, skills and modern engineering tools necessary for engineering practice</td>
</tr>
</tbody>
</table>

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

**Assessment and Evaluation:**
Understanding of fundamental concepts of Materials Science and Engineering will be evaluated through two in-class exams, and through a final group term paper relating design and engineering of material properties for specific technological applications.

Student understanding will be assessed throughout class in the form of quizzes, HWs, and in-class group activities, to ascertain that students are meeting desired learning outcomes.

**Grading Scale (Standard Letter Scale):**
- A = 90-100; B = 80-89.99; C = 70-79.99; D = 60-69.99; F = <60

**Grading Components:**
- Home Work: 10%
- Quizzes: 10%
- Exam: 20%
- Final Presentation: 20%
- Final Design Report: 30%
- Performance on Team: 10%

**Late Work Policy:**
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

**Attendance:**
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07). Please come on time. Silence cell-phones and other electronic distractions.

**Make-up Policy:**
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university -excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

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3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note
      from his or her medical provider within one week of the last date of the absence (see Student
      Rules 7.1.6.1)
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          at http://attendance.tamu.edu or
       b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall
    treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and
    related conditions as a justification for an excused absence for so long a period of time as is deemed
    medically necessary by the student's physician. Requests for excused absence related to pregnancy
    should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification
by the end of the second working day after the absence, including an explanation of why notice could not be sent
prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or
after the absence, but not later than two working days after the absence.

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with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their
disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services,
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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
- Submit original form and attach a course syllabus.

Form Instructions
1. Course request type:  ✔ Undergraduate  □ Graduate  □ First Professional (D.M.D, J.D., Pharm.D, D.V.M)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
MSEN 415, Defects in Solids
3. Course prefix, number and complete title of course:
4. Catalog course description (not to exceed 50 words):
Overview of point, line, and surface defects in solids; relates defect properties to diffusion, deformation, phase transformations; focuses on atomic defects in crystals, with additional examples from liquid crystals, superconductors, and ferromagnets; incorporates atomistic modeling to examine defect structure.

5. Prerequisite(s): MSEN 310 or approval of Instructor
Cross-listed with:  Stacked with:

Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course?  □ Yes  ✔ No  If yes, from  to  .
7. Is this a repeatable course?  □ Yes  ✔ No  If yes, this course may be taken  times.
Will this course be repeated within the same semester?  □ Yes  □ No
8. Will this course be submitted to the Core Curriculum Council?  □ Yes  □ No
9. How will this course be graded?  ✔ Grade  □ S/U  □ Pass/Fail (CR/MD)
10. This course will be:
a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
B.Sc. in Materials Science and Engineering
b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
B.Sc. in Materials Science and Engineering
11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.
12. ✔ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://epr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

13. Prefix  Course #  Title (excluding punctuation)
MSEN 415  DEFECTS IN SOLIDS

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<th>Other</th>
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Approval recommended by:

Ibrahim Karahan

Department Head or Program Chair (Type Name & Sign)  Date
Chair, College Review Committee  Date

Department Head or Program Chair (Type Name & Sign)  Date
(If cross-listed course)

Submitted to Coordinating Board by:

Associate Director, Curricular Services  Date

Questions regarding this form should be directed to Sandra Williams at 845-820; or sandra.williams@tamu.edu
Curricular Services - 07/14

Received DEC 16 2015
EASA

Received DEC 21 2015
CURRICULAR SERVICES
MSEN 415, Defects in Solids  
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:  
Michael J. Demkowicz, Reed McDonald Bldg. 231, 979.845.0750

Course (catalog) description: Overview of point, line, and surface defects in solids; relates defect properties to diffusion, deformation, phase transformations; focuses on atomic defects in crystals, with additional examples from liquid crystals, superconductors, and ferromagnets; incorporates atomistic modeling to examine defect structure.

Course Prerequisites: MSEN 310 or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
- Define and explain the structures and properties of point and electronic, line, and planar defects
- Describe mathematically the mutual interactions between defects
- Explain how the structure and properties of defects give rise to macroscale materials behaviors, such as diffusion, plastic deformation, and electrical/magnetic/optical properties.
- Construct atomistic models of defects, visualize the defects in these models, and use the models to compute defect properties

Textbooks:  
D. Hull and D. J. Bacon, Introduction to Dislocations (Butterworth Heinemann, 2006)

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Point defects:
- Week 1 Vacancies and interstitials
- Week 2 1\textsuperscript{st} atomistic modeling tutorial; multipole expansion
- Week 3 Defect reactions; 2\textsuperscript{nd} atomistic modeling tutorial
- Week 4 Defects in multicomponent systems; defects in amorphous solids

Line defects:
- Week 5 Ideal shear strength; Topology of dislocations
- Week 6 Dislocation-point defect interactions; configurational forces on dislocations
- Week 7 Midterm; Plastic deformation through dislocation glide
- Week 8 Dislocation climb; Dislocation-obstacle interactions
- Week 9 Strengthening mechanisms; stacking faults; dislocation reactions
Week 10: Hardening; dislocations in 2-D materials; line defects in liquid crystals, superfluids, and superconductors

Planar defects:

Week 11: Free surfaces; terrace-ledge-kink model
Week 12: Grain boundaries; coincident site lattices
Week 13: Heterophase interfaces; O-lattice theory; magnetic domain walls
Week 14: Final project presentations

Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Progress towards achieving learning outcomes will be evaluated through homework, exams, and final project. Peer review will be incorporated into the evaluation of homework assignments.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Midterm (25 %) {Week 5}
Final comprehensive exam: (25 %)
Final project presentation (25 %) {Week 14}
Homework (25 %) {Weekly}

Course will not be graded on a curve.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

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In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

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currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
Submit original form and attach a course syllabus.

Form Instructions
1. Course request type: ☑ Undergraduate ☐ Graduate ☐ First Professional (DDS, MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
MSEN 426, Polymer Laboratories
3. Course prefix, number and complete title of course:

4. Catalog course description (not to exceed 50 words):
Laboratory class to prepare students who are interested in polymer research with necessary experimental and analytical skills to conduct and analyze experimental work.

5. Prerequisite(s): MSEN 250; or approval of instructor

6. Is this a variable credit course? ☑ Yes ☐ No
    If yes, from ______ to ______
7. Is this a repeatable course? ☑ Yes ☐ No
    If yes, this course may be taken ______ times.
    Will this course be repeated within the same semester? ☐ Yes ☑ No
    Will this course be submitted to the Core Curriculum Council?
    ☐ Yes ☑ No
8. How will this course be graded? ☑ Grade ☐ S/U ☐ P/F (CLAD)
9. This course will be:
    a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
       B.S. in Materials Science and Engineering
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
       B.S. in Materials Science and Engineering
10. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.
11. ☑ I certify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

Prefix  Course #  Title (excluding punctuation)
MSEN  426  POLYMER LABORATORIES

Approval recommended by:
Ibrahim Karaman
Department Head or Program Chair (Type Name & Sign) Date

Date
Chair, College Review Committee

Date
Dean of College

Chair, GC or UCC

Date
Submitted to Coordinating Board by:

Associate Director, Curricular Services

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8204 or sandra.williams@tamu.edu
Curricular Services – 07/14
MSEN 426, Polymer Laboratories
Credits 3. 2 Lecture Hours, 3 Lab Hours.

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. H.-J. Sue, Reed McDonald Bldg. 222, hjsue@tamu.edu, 979-845-5024

Course (catalog) description: Laboratory class to prepare students who are interested in polymer research with necessary experimental and analytical skills to conduct and analyze experimental work.

Course Prerequisites: MSEN 250; or approval of instructor

Learning Outcomes: At the end of this course, students should be able to:
1. Demonstrate practical knowledge of polymer experimental techniques,
2. Describe the theory behind different experimental techniques,
3. Accurately and succinctly describe laboratory results.

Textbook: None.

Additional Material:
Experiments in Polymer Science, by E.A. Collins, J. Bares, and P.W. Billmeyer, JR. (Wiley)
Polymer: Polymer Characterization and Analysis, Jacqueline L. Kroschwitz
Instrumental Methods of Analysis, Hobart H. Willard
Physical Properties of Polymers Handbook, James E. Mark

Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1     Course Introduction
Week 2     Polymerization of Styrene
Week 3     Curing of Epoxy
Week 4     Rubber Swelling
Week 5     Thermal Gravitational Analyzer
Week 6     Density Measurements
Week 7     Surface Roughness Measurements
Week 8     Fracture Toughness
Week 9     Fourier Transform Infrared Spectroscopy
Week 10    Scratch Test
Week 11    Tensile Test
Week 12    DSC
Week 13-14 Summary and Data Analysis
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Evaluation of knowledge regarding experimental techniques will be evaluated through a combination of Lab results, Lab reports, Presentations, and a Final Exam.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Lab Performance 15%
Lab Reports 45% {Weekly}
Presentation 15% {Week 14}
Final Exam 25%

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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4. Participation in legal proceedings or administrative procedures that require a student's presence.
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Texas A&M University
Departmental Request for a New Course
Undergraduate + Graduate + Professional
• Submit original form and attach a course syllabus.

Form Instructions
1. Course request type: [✓] Undergraduate [ ] Graduate [ ] First Professional (DDS, MD, JD, Ph.D., DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
   MSEN 430, Nanomaterials Science
3. Course prefix, number and complete title of course:

4. Catalog course description (not to exceed 50 words):
   Nanotechnology and nanomaterials; types, fabrication, characterization methods, and applications; their current roles in technology and the future impact of such systems on industry targeting.

5. Prerequisite(s):

   Cross-listed with: [ ]

   Stacked with: [ ]

   Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course? [✓] No
   If yes, from _______ to _______

7. Is this a repeatable course? [✓] No
   If yes, this course may be taken _______ times.

8. Will this course be repeated within the same semester? [ ] Yes [ ] No

9. Will this course be submitted to the Core Curriculum Council? [ ] Yes [✓] No

10. How will this course be graded? [✓] Grade [ ] S/U [ ] P/F (CLAD)

11. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
      B.Sc. in Materials Science and Engineering
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
      B.Sc. in Materials Science and Engineering

12. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

13. Prefix | Course # | Title (excluding punctuation)
   --- | --- | ---
   MSEN | 430 | NANOMATERIALS SCIENCE

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Approval recommended by: [Signature]

Date: 12/15/2015

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu
Curricular Services – 07/14
MSEN 430, Nanomaterials Science  
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Ibrahim Karaman, Reed McDonald Bldg. 235, ikaraman@tamu.edu, 979-862-3923

Course (catalog) description: Nanotechnology and nanomaterials; types, fabrication, characterization methods, and applications; their current roles in technology, and the likely future impact of such systems on industry targeting.

Course Prerequisites: MSEN 310, junior or senior classification; or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
1. define nanotechnology and nanoscience
2. explain the effects of size scales on materials behavior
3. perform analysis using scaling laws to show why size scales affect certain materials response.
4. explain the new phenomena observed on the nanoscale
5. describe types of nanomaterials.
6. explain the basic principles and types of nanomaterials fabrication.
7. select appropriate techniques for fabricating nanostructures from different types of materials.
8. comprehend the limitation of conventional characterization techniques and learn about major characterization tools for the nanostructured materials
9. design experiments to characterize and determine properties of a given nanomaterial.
10. provide multiple examples of current and predicted applications of nanomaterials

Textbook: None.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1  Public: Awareness of Nanotechnology
Week 2  Effect of Size Scaling: Thermal Properties
Week 3  Effect of Size Scaling: Mechanical Properties
Week 4  Effect of Size Scaling: Electrical Properties
Week 5  Effect of Size Scaling: Magnetic Properties
Week 6  Effect of Size Scaling: Optical Properties
Week 7  New Behavior: surfaces
Week 8  New Behavior: Sticky/Shaky/Bumpy
Week 9  Nanostructured materials: shapes
Week 10  Nanostructured materials: applications
Week 11  Fabrication of Nanomaterials: Top-down approaches
Week 12  Fabrication of Nanomaterials: Bottom-up approaches
**Course Policies and Procedures:**

**Changes in schedule:**
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

**Assessment and Evaluation:**
The student progress will be evaluated through a combination of homeworks, a final exam, two laboratory experiments and reports, a term project and class presentation.

**Grading Scale (Standard Letter Scale):**
A = 90-100  
B = 80-89.99  
C = 70-79.99  
D = 60-69.99  
F = <60

**Grading Policies:**  
Homeworks (25%) \{Weekly\}  
Laboratory Reports (20%) \{Weeks 4 & 8\}  
Final Exam (35%) \{End of semester\}  
Term Project (20%) \{Week 14\}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

**Late Work Policy:**
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

**Attendance:**
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07). Please come on time. Silence cell-phones and other electronic distractions.

**Make-up Policy:**
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university -excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.
1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
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10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
Submit original form and attach a course syllabus.

Form Instructions
1. Course request type: [✓] Undergraduate [☐] Graduate [☐] First Professional (DDS, MD, JD, Ph.D., DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
   MSEN 440, Materials Electrochemistry and Corrosion
3. Course prefix, number and complete title of course:
   MSEN 440, Materials Electrochemistry and Corrosion
4. Catalog course description (not to exceed 50 words):
   Survey of thermodynamic and kinetic fundamentals of electrochemistry; multiscale materials corrosion mechanisms; details of interfacial aqueous electrochemical mechanisms and the environmental effects when materials are exposed to different conditions.

5. Prerequisite(s):
   MSEN 220; or approval of instructor

6. Is this a variable credit course? [☐] Yes [✓] No
   If yes, from _______ to _______.
7. Is this a repeatable course? [☐] Yes [✓] No
   If yes, this course may be taken _______ times.
   Will this course be repeated within the same semester? [☐] Yes [☐] No
8. Will this course be submitted to the Core Curriculum Council? [☐] Yes [✓] No
9. How will this course be graded: [✓] Grade [☐] S/U [☐] P/F (CLMT)
10. This course will be:
    a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
       B.Sc. in Materials Science and Engineering
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
       B.Sc. in Materials Science and Engineering
11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.
12. [✓] I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

13. | Prefix | Course # | Title (excluding punctuation) |
<table>
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<tr>
<td>MSEN</td>
<td>440</td>
<td>MATLS ELECTROCHEM CORROSION</td>
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<tr>
<td>Lect.</td>
<td>Lab</td>
<td>Other</td>
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<td>3.00</td>
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<tr>
<td>Approval recommended by:</td>
<td></td>
<td></td>
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<tr>
<td>Ibrahim Karaman</td>
<td></td>
<td></td>
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<tr>
<td>Date: 12/15/2015</td>
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<tr>
<td>Chair, College Review Committee</td>
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<td>Department Head or Program Chair (Type Name &amp; Sign)</td>
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<td>Dept of College</td>
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<td>Submitted to Coordinating Board by:</td>
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<tr>
<td>Associate Director, Curricular Services</td>
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</tbody>
</table>

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu
Curricular Services - 07/14
MSEN 440, Materials Electrochemistry and Corrosion  
Credits 3. 3 Lecture Hours  

Term: Fall 2017  

Meeting times and locations: TBD  

Instructor Information:  
Dr. Li Liu, Reed McDonald Bldg. 227, li.liu@tamu.edu, 979-458-1090  

Course (catalog) description: Survey of thermodynamic and kinetic fundamentals of electrochemistry; multiscale materials corrosion mechanisms; details of interfacial aqueous electrochemical mechanisms and the environmental effects when materials are exposed to different conditions.  

Course Prerequisites: MSEN 220; or approval of instructor  

Learning Outcomes: At the end of this course, students should be able to:  
- Describe fundamental corrosion mechanisms,  
- Demonstrate the use of modern engineering tools necessary for understanding basic principles in materials electrochemistry and corrosion,  
- Apply math, chemistry, and physics, to problems in corrosion.  


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.  

Course Outline:  

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Topic</th>
<th>Textbook Chapter</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to electrochemical cells and chemistry (potential redox, potential, pH)</td>
<td>1,2</td>
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<tr>
<td>2</td>
<td>Charged Interfaces (Electrolytes, Electrical double layer, potentials)</td>
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<tr>
<td>3</td>
<td>Thermodynamics review (State functions, Chemical potential, Nernst expression)</td>
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<td>4</td>
<td>Thermodynamics of materials electrochemistry (Electrochemical cells)</td>
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<td>5</td>
<td>Electrochemical Thermodynamics (E-pH diagrams at different conditions)</td>
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<td>6</td>
<td>Exam 1</td>
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<td>7</td>
<td>Kinetics of materials electrochemistry (Methods of determining corrosion rates by electrochemical testing)</td>
<td>7</td>
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<tr>
<td>8</td>
<td>Electrochemical polarization (Electrode kinetics for activation polarization)</td>
<td>7</td>
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<tr>
<td>9</td>
<td>Concentration polarization and Diffusion</td>
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<tr>
<td>10</td>
<td>Fundamentals on concentration polarization and corrosion</td>
<td>8</td>
</tr>
</tbody>
</table>
11 Exam 2
12 Application to surface conditions of materials (Corrosion and Passivity)
13 Application to Energy Devices (Batteries, Fuel Cells and Capacitors)
14 Applications to Environment and Health (Bioelectrochemistry, Biomaterials)

Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Effective knowledge of fundamental electrochemistry and corrosion mechanisms will be evaluated through homeworks, course projects, and exams.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Homework (30%) \{Weekly\}
Projects (40%) \{Weeks 4 & 8\}
Exams (30%) \{Weeks 6 & 11\}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at \text{http://student-rules.tamu.edu/rule07}.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at \text{http://student-rules.tamu.edu/rule07}. Please come on time. Silence cell-phones and other electronic distractions.

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If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.
The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
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3. Illness of a dependent family member.
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7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
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Departmental Request for a New Course
Undergraduate + Graduate + Professional
- Submit original form and attach a course syllabus.

1. Course request type: ☑ Undergraduate  □ Graduate  □ First Professional (DMD, MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
   MSEN 444, Corrosion and Electrochemistry Lab

4. Catalog course description (not to exceed 50 words):
   Laboratory practice and principles for corrosion and electrochemistry methods; students will design, carry out, and
   analyze a series of labs illustrating the most important techniques in the field; course builds to an open-ended
   corrosion engineering problem resulting in preparation of a technical report for a hypothetical client.

5. Prerequisite(s):
   MSEN 440

6. Is this a variable credit course?  □ Yes  ☑ No  If yes, from ________ to ________

7. Is this a repeatable course?  □ Yes  ☑ No  If yes, this course may be taken ________ times.

8. Will this course be submitted to the Core Curriculum Council?  □ Yes  □ No

9. How will this course be graded?  ☑ Grade  □ S/U  □ P/F (Cum)

10. This course will be:
    a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
       B.Sc. in Materials Science and Engineering
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
       B.Sc. in Materials Science and Engineering

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with those departments. Attach approval letters.

12. ☑ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://cte.tamico.edu/resources/export-control-basics-for-distance-education).

13. Prefix  Course #  Title (excluding punctuation)
    MSEN  444  CORROSION AND ELECTROCHEM LAB

    Lect.  Lab  Other  SCI  CIP and Fund Code  Admin. Unit  Acad. Year  FICE Code
    2.00  3.00  0.00  3.00  1418010006  1864  17 18 0 0 3 6 3 2

    Approval recommended by:
    Ibrahim Karaman
    Date 12/15/2015

    Department Head or Program Chair (Type Name & Sign)  Date  Chair, College Review Committee  Date
    Department Head or Program Chair (Type Name & Sign)  Date  Dean of College  Date
    (if cross-listed course)

    Submitted to Coordinating Board by:
    Chair, GC or UCC  Date

    Associate Director, Curricular Services  Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sara.williams@tamu.edu
Curricular Services – 07/14
MSEN 444, CORROSION AND ELECTROCHEMISTRY LABORATORY
Credits 3. 2 Lecture Hours, 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information: Dr. Homero Castaneda
Reed McDonald Bldg. 230, hcastaneda@tamu.edu, 979-458-9844

Course (catalog) description: Laboratory practice and principles for corrosion and electrochemistry methods; students will design, carry out, and analyze a series of labs illustrating the most important techniques in the field; course builds to an open-ended corrosion engineering problem resulting in preparation of a technical report for a hypothetical client.

Course Prerequisites: MSEN 440

Learning Outcomes: At the end of this course, students should be able to:
1. Demonstrate ability to use reference electrodes.
2. Demonstrate ability to conduct electrochemical and weight loss measurements of corrosion rate.
3. Demonstrate ability to generate potentiodynamic polarization curves to study passivity and localized corrosion.
4. Demonstrate ability to conduct measurements of polarization resistance
5. Demonstrate ability to use metallurgical methods for sample preparation and analysis.
6. Demonstrate ability to design experiments to characterize and study electrochemical/corrosion systems.

Textbook: Electrochemical Techniques in Corrosion Testing and Research, John Scully Editor, 1983

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
1 Introduction, laboratory safety
2 Lab 1: Materials sample and preparation (Metallography)
3 Lab 2. Materials Characterization (Microscopy)
4 Lab 3: Corrosion Rate, Weight Loss vs. Potentiostatic measurements
5 Lab 4: Tafel Slopes and Linear Polarization Resistance
6 Lab 5: Potentiodynamic Polarization, Active to Passive Transitions
7 Lab 6: Pitting Corrosion
8 Pitting corrosion (cont.)
9 Lab 7: Coatings
10 Lab 8: Cathodic Protection (galvanic anodes, impressed current)
11 Lab 9: Cathodic protection (coatings)
12 Lab 9: Batteries Characterization
13 Lab 10: Supercapacitors characterization
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
There will be ten laboratory assignments during the semester. For each laboratory assignment students are expected to produce a short individual technical report, which will be used to grade the assignment.

One final objective is to solve an open-ended corrosion engineering question for a hypothetical client. The student will design, carry out and analyze several corrosion experiments. The culmination of this analysis will be a report detailing the work and experimental approach as well as recommendations to the client.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Homework (30%) {Weekly}
Term Project (40%) {Week 13}
Exams (30%) {Weeks 8 & 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
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Texas A&M University

Departmental Request for a New Course
Undergraduate + Graduate + Professional
Submit original form and attach a course syllabus.

1. Course request type: ☑ Undergraduate  ☐ Graduate  ☐ First Professional (DSc, MD, JD, PharmD, DVM)

2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering

3. Course prefix, number and complete title of course: MSEN 446, Corrosion Prevention and Control Methods

4. Catalog course description (not to exceed 50 words):
Cathodic protection and coatings; functional engineering approach to controlling and preventing aqueous corrosion; impressed current, galvanic anodes, organic, inorganic and hybrid coatings; case studies in oil and gas, energy, automotive and different industries.

5. Prerequisite(s):

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<th>Cross-listed with:</th>
<th>Stacked with:</th>
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<tr>
<td>MSEN 440, MSEN 444, MEEN 360</td>
<td>Cross-listed courses require the signature of both department heads.</td>
</tr>
</tbody>
</table>

6. Is this a variable credit course? ☐ Yes  ☑ No  If yes, from ____ to ____

7. Is this a repeatable course? ☑ Yes  ☐ No  If yes, this course may be taken ____ times.

8. Will this course be repeated within the same semester? ☐ Yes  ☐ No

9. Will this course be submitted to the Core Curriculum Council? ☐ Yes  ☑ No

10. How will this course be graded? ☑ Grade  ☐ S/U  ☐ P/F (CLMD)

11. This course will be:

   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
      B.Sc. in Materials Science and Engineering
   
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
      B.Sc. in Materials Science and Engineering

12. I certify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-control/export-control-basics-for-distance-education).

13. Prefix  Course #  Title (excluding punctuation)

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<th>CORROSION PREV CTRL METHODS</th>
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Approval recommended by:

[Signature]

Department Head or Program Chair (Type Name & Sign)  Date

Chair, College Review Committee  Date

Department Head or Program Chair (Type Name & Sign)  Date

Dean of College  Date

Submitted to Coordinating Board by:

[Signature]

Chair, GC or UCC  Date

Associate Director, Curricular Services  Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services - 07/14
MSEN 446, CORROSION PREVENTION AND CONTROL METHODS
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information: Dr. Homero Castaneda
Reed McDonald Bldg. 230, hcastaneda@tamu.edu, 979-458-9844

Course (catalog) description: Cathodic protection and coatings as corrosion prevention and control methods for different applications; functional engineering approach to controlling and preventing aqueous corrosion based on engineering methodologies; impressed current, galvanic anodes, organic, inorganic and hybrid coatings; case of studies in the oil and gas, energy, automotive and different industries are included to illustrate the application of each method.

Course Prerequisites: MSEN 440; MSEN 444; MEEN 360

Learning Outcomes: At the end of this course, students should be able to:
- Demonstrate ability to use fundamentals and basics for cathodic protection design for different metallic structures.
- Demonstrate ability to select the most suitable action and solution for corrosion control and mitigation (coatings and cathodic protection) based on the system conditions.

Textbook: Morgan, Cathodic Protection, NACE.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
1 Overview of Corrosion Science and Engineering
2 Concept of Cathodic Protection
3 Cathodic Protection Systems
4 Field Measurements
5 CP design fundamentals and applications
6 Stray Currents
7 Evaluation of CP System Performance
8 Coating Fundamentals
9 Coatings types and curing mechanisms
10 Coatings types and curing mechanisms
11 Coatings surface preparation
12 Surface preparation instrumentation
13 Subsea case of studies in prevention and corrosion control
14 Oil and gas cases of study for cathodic protection design and coatings application
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Knowledge of corrosion prevention and control methods will be evaluated through homeworks, exams, and completion of class projects.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Homework (30%) {Weekly}
Project (30%) {Week 13}
Participation (Quizzes) (10%)
Exams (30%) {Weeks 8 & 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell-phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university -excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.
1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsorship/index
2. Death or major illness in a student’s immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student’s presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student’s physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

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Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

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Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
- Submit original form and attach a course syllabus.

Form Instructions
1. Course request type: ✓ Undergraduate  □ Graduate  □ First Professional (DDS, MD, JD, PharmD, DPhD)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
   MSEN 458, Fundamentals of Ceramics
3. Course prefix, number and complete title of course:

4. Catalog course description (not to exceed 50 words):
   Structure-property relationships of ceramics and ceramic composites; atomic bonding in ceramics; crystalline and glassy structures; phase equilibria and ceramic reactions; mechanical, electrical, thermal, dielectric, magnetic, and optical properties; and ceramic processing; different properties of ceramics will be related to their underlying structure.

5. Prerequisite(s): MSEN 310, or approval of Instructor
   Cross-listed with: 
   Stack with: MSEN 658
   Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course? □ Yes ✓ No
   If yes, from _____ to _____
7. Is this a repeatable course? □ Yes ✓ No
   If yes, this course may be taken _____ times.
   Will this course be repeated within the same semester? □ Yes □ No
8. Will this course be submitted to the Core Curriculum Council? □ Yes ✓ No
9. How will this course be graded? ✓ Grade □ S/U □ P/F (CLAS)
10. This course will be:
    a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
       B.Sc. in Materials Science and Engineering
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
       B.Sc. in Materials Science and Engineering
11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.
12. ✓ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

13. Prefix Course # Title (excluding punctuation)
    MSEN 458 FUNDAMENTALS OF CERAMICS

    | Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code |
    |-------|-----|-------|-----|------------------|-------------|------------|-----------|
    | 3.00  | 0.00| 0.00  | 3.00| 4010010002       | 1864        | 17         | 18        |

Approval recommended by: 

Ibrahim Karahan
Department Head or Program Chair (Type Name & Sign) Date 12/15/2015
Chair, College Review Committee Date

Department Head or Program Chair (Type Name & Sign) Date
(if cross-listed course)

Submitted to Coordinating Board by:

Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services – 07/14
MSEN 458, Fundamentals of Ceramics  
Credits 3. 3 Lecture Hours

Stacked with MSEN 658  
Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:  
Dr. Miladin Radovic, Reed McDonald Bldg. 216, mradovic@tamu.edu, 979-845-5114

Course (catalog) description: Structure-property relationships of ceramics and ceramic composites; atomic bonding in ceramics; crystalline and glassy structures; phase equilibria and ceramic reactions; mechanical, electrical, thermal, dielectric, magnetic, and optical properties; and ceramic processing; different properties of ceramics will be related to their underlying structure.

Course Prerequisites: MSEN 310; or approval of instructor

Learning Outcomes: At the end of this course, students should be able to:  
- Recognize basic structures of ceramics and glass;  
- Correlate processing conditions to the structure of ceramics and glasses;  
- Correlate properties of ceramics and glasses to the their structure;  
- Select ceramic materials for different applications;  
- Design components from ceramics and glasses.


Additional Material:  

Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:  
Week 1  Bonding in Ceramics  
Week 2  Structure of Ceramics  
Week 3  Thermodynamic and Kinetic Considerations
Week 4        Phase Equilibria
Week 5        Effects of Chemical Forces on Physical Properties
Week 6        Defects in Ceramics
Week 7        Diffusion and Electrical Conductivity
Week 8        Mechanical Properties: Fast Fracture
Week 9        Thermal Properties
Week 10       Magnetic and Dielectric Properties
Week 11       Optical Properties
Week 12       Processing of Ceramics
Week 13       Structure of Glass
Week 14       Properties of Glass

Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Knowledge of ceramic structures and properties will be evaluated through four tests and an optional final exam.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Test 1 (18%) {Week 3}
Test 2 (18%) {Week 6}
Test 3 (18%) {Week 9}
Test 4 (18%) {Week 12}
Final Exam (28%)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
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Texas A&M University
Departmental Request for a New Course
Undergraduate + Graduate + Professional
Submit original form and attach a course syllabus.

Form Instructions
1. Course request type: 🔵 Undergraduate ☐ Graduate ☐ First Professional (MD, JD, PharmD, D/V/D)

2. Request submitted by (Department or Program Name):
Department of Materials Science and Engineering

3. Course prefix, number and complete title of course:
MSEN 462, Advanced Materials Characterization

4. Catalog course description (not to exceed 50 words):
Principles and techniques used in characterization of different materials, including metals, ceramics, polymers, composites, and semiconductor systems; microstructural, chemical/compositional, and surface analysis methods; interpretation and analysis of the characterization results.

5. Prerequisite(s):
MSEN 220, MSEN 250, MSEN 310; or approval of instructor

6. Is this a variable credit course? ☐ Yes 🔵 No
If yes, from _______ to _______

7. Is this a repeatable course? ☐ Yes 🔵 No
If yes, this course may be taken _______ times.

8. Will this course be repeated within the same semester? ☐ Yes ☐ No

9. Will this course be submitted to the Core Curriculum Council? ☐ Yes 🔵 No

10. How will this course be graded? 🔵 Grade ☐ S/U ☐ P/F (CLAM)

11. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
      B.Sc. in Materials Science and Engineering
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
      B.Sc. in Materials Science and Engineering

12. ☐ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://cyw.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

13. Prefix | Course # | Title (excluding punctuation)
-------- | -------- | ------------------
MSEN | 462 | ADV MATLS CHARACTERIZATION

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Approval recommended by:
Ibrahim Karaman
Department Head or Program Chair (Type Name & Sign) Date 12/15/2015

Chair, College Review Committee Date

Dean of College Date

Submitted to Coordinating Board by:
Chair, GC or UCC Date

Associate Director, Curricular Services Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services - 07/14
SYLLABUS

MSEN 462, Advanced Materials Characterization
Credits 3, 2 Lecture Hours, 3 Laboratory Hours.

Term: Fall 2017
Meeting times and locations: TBD

Instructor Information:
Dr. Patrick Shamberger, Reed McDonald Bldg. 229, patrick.shamberger@tamu.edu, 979-458-1086

Course (catalog) description: Principles and techniques used in characterization of different materials, including metals, ceramics, polymers, composites, and semiconductor systems; microstructural, chemical/compositional, and surface analysis methods; interpretation and analysis of the characterization results.

Course Prerequisites: MSEN 220, MSEN 250, MSEN 310; or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
1. Grasp the principles and theory behind advanced materials characterization techniques;
2. Understand the instrumentation requirement, set-up, and performance capabilities and limitations of these materials characterization techniques;
3. Select appropriate method for structural, microstructural, chemical and surface analysis of different materials;
4. Interpret and analyze results from advanced materials characterization techniques;
5. Present and effectively communicate results of materials characterization.

Textbook:

Additional Material:
Yang Leng, Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, 2nd Ed., Willey, 2013

Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1  X-Ray Diffraction and Scattering and Neutron Diffraction and Scattering with lab demonstrations;
Week 2  Optical Microscopy (OM) and Scanning Electron Microscopy (SEM)
Week 3  Transmission Electron Microscopy (TEM)
Week 4  Atomic Force Microscopy (AFM)/Scanning Probe Microscopy (SPM)
Week 5  Microanalysis in Electron Microscopy: Energy/Wavelength Dispersive Spectroscopy (EDS/WDS); Electron Backscatter Diffraction (EBSD); Electron Energy Loss Spectroscopy (EELS)
Week 6  OM, SEM, TEM, AFM, EDS, EBSD, and EELS lab demonstrations;
Week 7: Mid-term exam
Chemical Analysis of Surface Composition: X-Ray Fluorescence (XRF); X-Ray and Ultraviolet Photoelectron Spectroscopy (XPS/UPS)

Week 8: Auger Electron Spectroscopy (AES); Secondary Ion Mass Spectrometry (SIMS)

Week 9: Photoluminescence (PL), Absorption/Transmission Spectroscopies; Visible and Near-IR Spectroscopy

Week 10: Fourier Transform Infrared Spectroscopy (FTIR); Raman Spectroscopy

Week 11: Lab demonstration of spectroscopy methods

Week 12: Mass Spectrometry (MS) with lab demonstration

Week 13: Nuclear Magnetic Resonance Spectroscopy (NMR) with lab demonstration

Week 14: Project presentations

Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Progress towards achieving learning outcomes will be evaluated through homework, exams, and final project. Peer review will be incorporated into the evaluation of final project reports and presentations.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Mid-semester exam (25%) {Week 7}
Final Exam (25%) {Week 15}
Project presentation and report (20%) {Week 14}
Homework assignments (30%) {Weekly}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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currently located in the Disability Services building at the Student Services at White Creek complex on west
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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
Submit original form and attach a course syllabus.*

Form Instructions
1. Course request type: ☑ Undergraduate ☐ Graduate ☐ First Professional (D.D.S., M.D., J.D., Pharm.D., D.P.M.)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
3. Course prefix, number, and complete title of course: MSEN 472, Atomistic Simulation of Materials
4. Catalog course description (not to exceed 50 words):
Modern methods of computational modeling and simulation of materials properties and phenomena at the atomistic scale; quantum, classical, and statistical mechanical methods, including semi-empirical atomic and molecular-scale simulations, and other modeling techniques using macroscopic input.

5. Prerequisite(s):
Cross-listed with: MSEN 370; or approval of Instructor
Stacked with: MSEN 670

6. Is this a variable credit course? ☐ Yes ☑ No
   If yes, from _____ to _____
7. Is this a repeatable course? ☐ Yes ☑ No
   If yes, this course may be taken _____ times.
   Will this course be repeated within the same semester? ☐ Yes ☑ No
8. Will this course be submitted to the Core Curriculum Council? ☐ Yes ☑ No
9. How will this course be graded: ☑ Grade ☐ S/U ☐ P/F (CLD)
10. This course will be:
    a. required for students enrolled in the following degree programs(s) (e.g., B.A. in history)
       B.Sc. in Materials Science and Engineering
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
       B.Sc. in Materials Science and Engineering
11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.
12. ☑ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-controles-basics-for-distance-education).
13. Prefix Course # Title (excluding punctuation)
    MSEN 472 ATOMIC SIMULATION MATLS
    Lect. Lab Other SCH CIP and Fund Code Admin. Unit Acad. Year FICE Code
    3.00 0.00 0.00 3.00 4010010002 1864 17 - 18 0 0 3 6 3 2

Approval recommended by:

Ibrahim Karanam
Department Head or Program Chair (Type Name & Sign) Date
Chair, College Review Committee Date

Department Head or Program Chair (Type Name & Sign) Date (if cross-listed course)
Dean of College Date

Submitted to Coordinating Board by:
Chain GC or UCC Date

Associate Director, Curricular Services Date

Questions regarding this form should be directed to Sandra Williams at 845-8701 or sandra.williams@tamu.edu
Curricular Services - 07/14
MSEN 472, Atomistic Simulation of Materials  
Credits 3  3 Lecture Hours

Stacked with MSEN 670  
Term: Fall 2017

Meeting times and locations:  TBD

Instructor Information:  
Dr. Xiaofeng Qian, Reed McDonald Bldg. 226, feng@tamu.edu, 979-458-9843

Course (catalog) description: Modern methods of computational modeling and simulation of materials properties and phenomena at the atomistic scale; quantum, classical, and statistical mechanical methods, including semi-empirical atomic and molecular-scale simulations, and other modeling techniques using macroscopic input.

Course Prerequisites:  MSEN 370; or approval of instructor.

Learning Outcomes:  At the end of this course, students should be able to:
1. Differentiate the fidelity and assumptions of different scales of atomistic simulations,
2. Apply quantum mechanical methods, classical methods based on empirical potentials, and continuum methods to describe different fundamental materials problems,
3. Describe weaknesses and strengths of different scale simulation methods.

Textbook:  None.

Additional Material:  Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:

Week 1  Introduction to Modeling in Materials  
Week 2-4  Quantum Mechanical Methods  
Week 5-8  Interaction Potentials for Materials  
Week 9-12  Classical Simulation Methods  
Week 13-14  Continuum Methods

Course Policies and Procedures:  
Changes in schedule:  
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:  
Knowledge of application and theory of atomistic simulation will be demonstrated through homework sets, and through a final term project.
Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Class Participation (10%)
Homework sets (40%) {Weekly}
Term Project (50%) {Week 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer's discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell-phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07 ). The fact that these are university excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
   a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
   b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

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The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University
Departmental Request for a New Course
Undergraduate + Graduate + Professional
* Submit original form and attach a course syllabus.*

Form Instructions
1. Course request type:  
   - Undergraduate  
   - Graduate  
   - First Professional (DDS, MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name):  
   Department of Materials Science and Engineering
3. Course prefix, number and complete title of course:  
   MSEN 474, Material's Modeling of Phase Transformation and Microstructural Evolution
4. Catalog course description (not to exceed 50 words):
   Computer modeling and simulation of microstructural evolution during various phase transformation processes in solid materials, including spinodal decomposition, ordering, martensitic transformation, ferroelectric and ferromagnetic domain evolution, nucleation, growth, solidification.

5. Prerequisite(s):  
   MSEN 370; or approval of instructor

6. Is this a variable credit course?  
   - Yes  
   - No  
   If yes, from _____ to _____

7. Is this a repeatable course?  
   - Yes  
   - No  
   If yes, this course may be taken _____ times.

8. Will this course be repeated within the same semester?  
   - Yes  
   - No

9. Will this course be submitted to the Core Curriculum Council?  
   - Yes  
   - No

10. How will this course be graded?  
    - Grade  
    - S/U  
    - P/F (CLAS)

11. This course will be:  
    a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)  
       B.S. in Materials Science and Engineering
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)  
       B.S. in Materials Science and Engineering

12. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

13. Prefix  
    Course #  
    Title (excluding punctuation)
    MSEN 474  
    MATLS MODELING PHASE TRANS MIC

    Lect.  
    Lab  
    Other  
    SCII  
    CIP and Fund Code  
    Admin. Unit  
    Acad. Year  
    FICE Code  
    2.00  
    3.00  
    0.00  
    3.00  
    1418010006  
    1864  
    17 - 18  
    0 0 3 6 3 2  

    Approval recommended by:
    Ibrahim Karaman  
    Department Head or Program Chair (Type Name & Sign)  
    12/15/2015  
    Chair, College Review Committee  
    Date
    Department Head or Program Chair (Type Name & Sign)  
    (if cross-listed course)  
    Date
    Dean of College  
    Date
    Submitted to Coordinating Board by:
    Chair, GC or UCC  
    Date

Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 07/14

[Stamp: RECEIVED DEC 16 2015]
[Stamp: RECEIVED DEC 21 2015]
MSEN 474, Materials Modeling of Phase Transformation and Microstructural Evolution  
Credits 3. 2 Lecture Hours, 3 Lab Hours

Stacked with MSEN 619  
Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:  
Dr. Amine Benzerga, HRBB 736C, benzerga@tamu.edu, 979.845.1602

Course (catalog) description: Computer modeling and simulation of microstructural evolution during various  
phase transformation processes in solid materials, including spinodal decomposition, ordering, martensitic  
transformation, ferroelectric and ferromagnetic domain evolution, nucleation, growth, solidification.

Course Prerequisites: MSEN 370, or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
1. Apply basic concepts of thermodynamics and kinetics of heterogeneous systems to the understanding of  
microstructure evolution of materials
2. Understand the basic principles behind diffuse interface modeling framework
3. Apply variational principles to arrive at kinetic evolution equations from functional thermodynamic  
descriptions
4. Use FiPy as the computational framework to implement phase field modeling of microstructures
5. Use basic numerical methods to implement solutions to the Cahn-Hilliard and Allen-Cahn equations

Textbook: Course Notes by Instructors

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material  
will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 Thermodynamics of Microstructures
Week 2 Functions and functionals and Variational Calculus
Week 3 Sharp vs Diffuse Interface
Week 4 The Cahn-Hilliard Equation
Week 5 The Allen-Cahn Equation
Week 6 Phase-field Models
Week 7 Phase-field Models: the structure of interfaces
Week 8-9 Application of Phase Field Modeling to Solidification
Week 10-12 Application of Phase Field Modeling to Solid-Solid Phase Transformations
Week 13 The problem of nucleation
Week 14 Multi-physics Phase Field Modeling
Course Policies and Procedures:
Changes in Schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course will be evaluated through quizzes and projects.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Quizzes: 20% \{Weekly\}
Project 1: 20% \{Week 5\}
Project 2: 25% \{Week 9\}
Project 3: 35% \{Week 14\}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07 .

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07 . Please come on time. Silence cell-phones and other electronic distractions.

Make-up Policy:
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3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
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      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

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Texas A&M University
Departmental Request for a New Course
Undergraduate + Graduate + Professional

Form Instructions
1. Course request type: ✓ Undergraduate  □ Graduate  □ First Professional (DDE, MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
3. Course prefix, number and complete title of course: MSEN 476, Multi-Scale Computational Materials Science

Catalog course description (not to exceed 50 words):
Problem-based advanced course, illustrating elements of challenges associated with multi-scale simulations; examining multi-scale modeling of elastic response of a multi-phase microstructure; elements of uncertainty quantification and propagation.

5. Prerequisite(s):
MSEN 370; or approval of Instructor

6. Is this a variable credit course? □ Yes  ✓ No

7. Is this a repeatable course? □ Yes  ✓ No

8. Will this course be submitted to the Core Curriculum Council? □ Yes  ✓ No

9. How will this course be graded? ✓ Grade  □ S/U  □ P/F (CLPD)

10. This course will be:
a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
   B.Sc. in Materials Science and Engineering
b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
   B.Sc. in Materials Science and Engineering

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

12. I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-control-basics-for-distance-education).

13. Prefix | Course # | Title (excluding punctuation)
--- | --- | ---
MSEN | 476 | MULTISCALE COMPTL MATLS SCI

Lect. | Lab | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FICE Code
--- | --- | --- | --- | --- | --- | --- | ---
2.00 | 3.00 | 0.00 | 3.00 | 1418010006 | 1864 | 17 | 18 | 0 0 3 6 3 2

Approved recommended by:

[Signature]

Department Head or Program Chair (Type Name & Sign) Date

[Signature]

Chair, College Review Committee Date

[Signature]

Dean of College Date

Submitted to Coordinating Board by:

[Signature]

Chair, GC or UCC Date

Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845-8201 or swood@tamu.edu.
Curricular Services – 07/14
MSEN 476, Multi-Scale Computational Materials Science
Credits 3. 2 Lecture Hours, 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Dimitris Lagoudas, HRBB 109C, d-lagoudas@tamu.edu, 979.845.1604

Course (catalog) description: This is a problem-based advanced course illustrating elements of the challenges associated with multi-scale simulations in materials science. As an example, the course will examine the multi-scale modeling of elastic response of a multi-phase microstructure. Elements of uncertainty quantification and propagation will be central to the course.

Course Prerequisites: MSEN 370, or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
1. Recognize the strengths and limitations associated with different computational materials modeling techniques
2. Recognize the challenges associated with simulation of materials systems across multiple scales in space and time
3. Understand basic concepts of model uncertainty
4. Apply of simple methods for uncertainty quantification and propagation to multi-scale materials problems
5. Implement practical schemes for information passing across two simulation scales

Textbook: None.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 The problem: Elastic Response of a Multi-phase Microstructure
Week 2 Models, Reality and Uncertainty
Week 3 Model Sensitivity and Model Validation
Week 4 Elements of Quantification of Uncertainty
Week 5 The Problem: From Electronic Structure to Elastic Properties of Materials
Week 6 Sampling Methods – Monte Carlo Methods
Week 7 The Problem: Using Molecular Dynamics to Predict Elastic Properties of Materials
Week 8 Elements of Parameter Estimation
Week 9 The Problem: Predicting Elastic Response of Multi-phase Microstructure
Week 10 Micromechanics
Week 11 Homogenization methods
Week 12 Multi-scale Models and Loss of Information
Week 13 Uncertainty Quantification in Multi-scale Computational Materials Science
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course will be evaluated through quizzes and projects.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Quizzes: 20% {Weekly}
Project 1: 20% {Week 4}
Project 2: 25% {Week 9}
Project 3: 35% {Week 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendace.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
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Other absences may be excused at the discretion of the instructor with prior notification and proper documentation

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
Submit original form and attach a course syllabus.

Form Instructions
1. Course request type:
   - Undergraduate [☑]
   - Graduate [ ]
   - First Professional (DDS, MD, JD, PharmD, DVM) [ ]

2. Request submitted by (Department or Program Name):
   Department of Materials Science and Engineering

3. Course prefix, number and complete title of course:
   MSEN 480, Communicating Materials Science and Engineering

4. Catalog course description (not to exceed 50 words):
   Effective communication of technical topics in materials science and engineering to technical and non-technical audiences; emphasis on oral and visual presentations.

5. Prerequisite(s):
   - MSEN 401 or registration therein
   Cross-listed with: ____________________________
   Stacked with: ____________________________

6. Is this a variable credit course? [ ] Yes [☑] No
   If yes, from _______ to _______

7. Is this a repeatable course? [ ] Yes [☑] No
   If yes, this course may be taken ______ times.

   Will this course be repeated within the same semester? [ ] Yes [ ] No

8. Will this course be submitted to the Core Curriculum Council? [ □ ] Yes [☑] No

9. How will this course be graded? [☑] Grade [ ] S/U [ ] P/F (C.I.E.M.)

10. This course will be:
    a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
       B.Sc. in Materials Science and Engineering
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

12. [☑] I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

13. Prefix     Course #     Title (excluding punctuation)
    MSEN     480     COMMUNICATING MATLS SCI ENG

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<th>Lab</th>
<th>Other</th>
<th>SCH</th>
<th>CIP and Fund Code</th>
<th>Admin. Unit</th>
<th>Acad. Year</th>
<th>Class Code</th>
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</tr>
</tbody>
</table>

Approval recommended by:

Ibrahim Karanam
Department Head or Program Chair (Type Name & Sign) Date

Chair, College Review Committee Date

Dean of College Date

Submitted to Coordinating Board by:

Chair, GC or UCC Date

Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services – 01/14
MSEN 480, Communicating Materials Science and Engineering
1 Credit, c Course

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Ted Hartwig, Reed MacDonald Bldg. 220, thartwig@tamu.edu, 979-845-1585

Course (catalog) description: Effective communication of technical topics in materials science and engineering
to technical and non-technical audiences; emphasis on oral and visual presentations.

Course Prerequisites: MSEN 401 or registration therein.

Learning Outcomes: At the end of this course, students should be able to:
1. Prepare a technical abstract describing a short seminar.
2. Communicate technical results in report form in either a letter or e-mail.
3. Develop a clear and informative figure visually displaying quantitative information
4. Present a brief, no visual-aids technology ‘pitch’.
5. Effectively communicate an important concept in the field of materials science to a non-technical audience.
6. Deliver a 10-minute technical presentation to an audience of your peers.
7. Assemble and present a technical poster to an audience of your peers.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material
will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 Course Introduction/Communication Mechanics
Week 2 The ‘Pitch’: pt 1
Week 3 The ‘Pitch’: pt 2
Week 4 The Abstract
Week 5 Non-technical Presentations: Grabbing Attention
Week 6 Non-technical Presentations: Explaining Complicated Ideas Simply
Week 7 Technical Oral Presentations: Intro/Background
Week 8 Technical Oral Presentations: Data/Results
Week 9 Technical Oral Presentations: Takeaway Points
Week 10 Posters: Layout
Week 11 Posters: The Figure
Week 12 Posters: Content
Week 13 Presenting Technical Posters
Week 14 Presenting through video
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Effective communication techniques will be evaluated through oral, written, and visual presentations. Peer evaluation, and continued revision and improvement of first draft materials will play important roles in gaining a mastery of the course material. This course is a formal c (communication) course. Thus, 1 crh (100 % of grade) will be based on form, content, and style of student presentations.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Technology 'pitch' (10%) {Week 3}
Abstract (10%) {Week 5}
Non-technical Presentations (20%) {Week 6}
Technical Presentations (20%) {Week 9}
Figure (10%) {Week 12}
Poster Presentations (20%) {Week 13}
Video Presentations (10%) {Week 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell-phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university
- excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsorAuth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

Form Instructions:
1. Course request type: ☑ Undergraduate □ Graduate □ First Professional (DDS, MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
3. Course prefix, number and complete title of course:
   MSEN 484, Internship
4. Catalog course description (not to exceed 50 words):
   Practical experience working in a professional materials science and engineering setting offered on an individual basis.

5. Prerequisite(s): Junior or Senior classification, approval of instructor

6. Is this a variable credit course? ☑ Yes □ No If yes, from ___ to ___
7. Is this a repeatable course? □ Yes ☑ No If yes, this course may be taken ___ times.
   Will this course be repeated within the same semester? □ Yes ☑ No
8. Will this course be submitted to the Core Curriculum Council? □ Yes ☑ No
9. How will this course be graded? □ Grade ☑ S/U □ P/F (CLMD)
10. This course will be:
    a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
    b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)
    B.Sc. in Materials Science and Engineering

If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

☑ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-control/export-controls-basics-for-distance-education).

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Course #</th>
<th>Title (excluding punctuation)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>484</td>
<td>INTERNSHIP</td>
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<tr>
<td>Lect.</td>
<td>Lab</td>
<td>Other</td>
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</tr>
</tbody>
</table>

Approval recommended by:

Ibrahim Karanan

Department Head or Program Chair (Type Name & Signature) Date

Chair, College Review Committee Date

Department Head or Program Chair (Type Name & Signature) Date

Dean of College Date

Submitted to Coordinating Board by:

Chair, GC or UCC Date

Associate Director, Curricula Services Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 07/14
MSEN 484, Internship  
Credits 0-4.

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information: 
Dr. Michael J. Demkowicz, Reed McDonald Bldg. 231, 979.845.0750

Course (catalog) description: Practical experience working in a professional materials science and engineering setting offered on an individual basis.

Course Prerequisites: Junior or Senior classification, approval of instructor

Learning Outcomes: At the end of this course, students should be able to:
1. Formulate and solve engineering problems,
2. Function on multi-disciplinary teams,
3. Act in a professional and ethical manner,
4. Communicate effectively, and
5. Apply synthesis, characterization, or simulation methods towards solving complex materials-related challenges.

Textbook: none.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
None.

Course Policies and Procedures:
Assessment and Evaluation:
Internships will be completed on a Satisfactory/Unsatisfactory basis only. Satisfactory grade requires completion of reflection assignment at the internship midpoint and at the conclusion of the internship, as well as favorable employer feedback at the end of the internship. The student is responsible for soliciting a letter of evaluation at the end of the internship.

Grading Scale (Standard Letter Scale):
S = Satisfactory
U = Unsatisfactory

Grading Policies:
Satisfactory grade requires completion of reflection assignment at the beginning, midpoint and at the conclusion of the internship, as well as a favorable letter from supervisor at the completion of the internship.
Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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      b) Confirmation of visit to a health care professional affirming date and time of visit.
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Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

Form Instructions:
1. Course request type: [□ Undergraduate □ Graduate □ First Professional (DDS, MD, J.D. PharmD, DivM)]
2. Request submitted by (Department or Program Name): Educational Administration and Human Resource Development
3. Course prefix, number and complete title of course: TCMG 486 Cybersecurity Capstone Seminar
4. Catalog course description (not to exceed 50 words): Capstone seminar on significant issues in industry; examination of current trends in the cybersecurity field; investigation into the multidisciplinary nature of cybersecurity events and incursions.

5. Prerequisite(s): CSCE 110 or CSCE 121; CSCE 206 or CSCE 221; TCMG 308; Junior or Senior classification or approval of instructor

Cross-listed with: 
Stacked with:

Cross-listed courses require the signature of both department heads.

6. Is this a variable credit course? [□ Yes □ No] If yes, from _______ to _______
7. Is this a repeatable course? [□ Yes □ No] If yes, this course may be taken _______ times.
   Will this course be repeated within the same semester? [□ Yes □ No]
8. Will this course be submitted to the Core Curriculum Council? [□ Yes □ No]
9. How will this course be graded: [□ Grade □ S/U □ P/F (CLMD)]

10. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
      Minor in Cybersecurity
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

11. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.
12. [□] I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

13. Prefix Course # Title (excluding punctuation)
   TCMG 486 CYBERSECURITY CAPSTONE SEMINAR

<table>
<thead>
<tr>
<th>Lect.</th>
<th>Lab</th>
<th>Other</th>
<th>SCH</th>
<th>CIP and Fund Code</th>
<th>Admin. Unit</th>
<th>Acad. Year</th>
<th>FICE Code</th>
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</table>

Approval recommended by:

Department Head – Dr. Frederick M. Nafukho
Date: 11/17/2015

Chair, College Review Committee
Date

Dean of College
Date

Submitted to Coordinating Board by:
Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Course title and number  TCMG 486: Cybersecurity Capstone Seminar
Term  TBD  Fall / Spring
Meeting times and location  TBD

Course Description and Prerequisites

Capstone Seminar. (1-1). Credit 1. Capstone seminar on significant issues in industry; examination of current trends in the cybersecurity field; investigation into the multidisciplinary nature of cybersecurity events and incursions. Prerequisites: CSCE 110 or CSCE 121; CSCE 206 or CSCE 221; TCMG 308; Junior or senior classification or approval of instructor.

Learning Outcomes or Course Objectives

At the completion of this course, students should be able to:
- Define cybersecurity defense and fortification by applying ethical principles to the profession.
- Differentiate cybersecurity threat and risk levels corresponding to vectors of attack.
- Identify security principles, threat, and attack techniques used to gain unauthorized access to computer systems.
- Synthesize techniques to properly arm and countermeasure systems through toolsets aimed at mitigation of risk that foster resilient, assured information technology operations.

Instructor Information

Name  TBD
Office Phone  TBD
Email
Office Hours
Office Location

Textbook and/or Resource Material

Required Textbook
*Digital Ethics: Research and Practice, ISBN: 978-1433118951, Publisher: Peter*
Other Required Material:
- Use of ecampus for grade tracking and exam taking

Grading Policies

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Points</th>
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<tbody>
<tr>
<td>Exam 1</td>
<td>150</td>
</tr>
<tr>
<td>Exam 2</td>
<td>150</td>
</tr>
<tr>
<td>Exam 3</td>
<td>150</td>
</tr>
<tr>
<td>Final Project in lieu of exam</td>
<td>150</td>
</tr>
<tr>
<td>Labs (6 labs @ 50 pts each)</td>
<td>300</td>
</tr>
<tr>
<td>Class Participation</td>
<td>100</td>
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</tbody>
</table>

Please note that total points, not aggregate percent, establish the grade you will receive in this course. Final grades are summative point totals and determined as follows:

- 900 – 1000 points: A
- 800 – 899 points: B
- 700 – 799 points: C
- 600 – 699 points: D
- < 600 points: F

Attendance

Class attendance is essential for student success; therefore, students are required to promptly and regularly attend all their classes. A record of attendance will be maintained from the first day of classes and/or the first day the student’s name appears on the roster through final examinations and constitute the participation grade for the course. Each day you attend, you earn attendance points. Being late to class will cost a percentage of the points for the class period. Missing more than 30 minutes of a lecture or lab period without a University excused absence will result in a loss of attendance points for the day. Absences may only be excused as defined by the Texas A&M University Student Rules available at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

In the event of a University excused absence, students have the option to complete a small make-up assignment focused on introducing course content for the day of the absence, or students may elect to have their attendance grade calculated instead on the basis of the total number of course sessions they were able to attend during the semester. For example, this course meets one time a week. With an excused absence, a student may elect to complete a small assignment, or have their participation calculated using 13 weeks instead of 14.
Assignments, Missed Exams or Quizzes

- Work must be ready to be turned when it is due for to be considered “on time.” Late work will not be accepted, except in cases of University excused absences.
- Students with excused absences may make-up missed exams with no penalty. Students are requested to schedule the make-up immediately upon their return to the class. All make-ups must be completed within 30 calendar days of student’s return to class.
- Make-up for any unexcused absence is at the discretion of the instructor.

Americans with Disabilities Act (ADA)

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Academic Integrity

Any incident involving academic dishonesty will result in a grade of F* in the course and students will be referred to the Aggie Honor Code Office for academic and/or disciplinary action.

"An Aggie does not lie, cheat, or steal, or tolerate those who do."
For additional information please visit: http://aggiehonor.tamu.edu

Calendar of Activities, Assignment Milestones
(subject to change as necessary)

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Welcome, syllabus, learning outcomes, student expectations for the course, course pretest</th>
<th>Review of Cybersecurity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 2</td>
<td>Why ethical principles?</td>
<td>Types of Hacking and the Agreement process</td>
</tr>
<tr>
<td>Week 3</td>
<td>Organizational Project Enabling</td>
<td>Project Processes</td>
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<tr>
<td>Week 4</td>
<td>Lab- Nascence</td>
<td>Review</td>
</tr>
<tr>
<td>Week 5</td>
<td><strong>Exam 1 in class</strong></td>
<td>Technical Processes</td>
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<tr>
<td>Week 6</td>
<td>Technical Processes</td>
<td>Software Implementation Process</td>
</tr>
<tr>
<td>Week 7</td>
<td>Supporting Processes</td>
<td>Lab- technical</td>
</tr>
<tr>
<td>Week 8</td>
<td>Lab- software implementation</td>
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<tr>
<td></td>
<td>Standard Process Models; <strong>Exam 2 remote</strong></td>
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<tr>
<td>Week 9</td>
<td>Exam 2 redux; Security Management</td>
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<tr>
<td></td>
<td>Lab- Security Management</td>
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<tr>
<td>Week 10</td>
<td>Software Assurance</td>
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<tr>
<td></td>
<td>Building Security in Mature Organizations</td>
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<tr>
<td>Week 11</td>
<td>The Law</td>
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<tr>
<td></td>
<td>Information studies on extraordinary access models</td>
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<tr>
<td>Week 12</td>
<td>Expectations of privacy</td>
<td></td>
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<tr>
<td></td>
<td>Lab- Just because you can... doesn't mean you should</td>
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<tr>
<td>Week 13</td>
<td>Resolving Ethical Dilemmas in Information Technology</td>
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<td></td>
<td>Lab- Ethical Dilemmas</td>
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<td>Week 14</td>
<td>User behavior paradigms</td>
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<td><strong>Exam 3 online</strong></td>
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<td></td>
<td>Exam 3 redux, project review</td>
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<tr>
<td>Week 15</td>
<td>Final examination week</td>
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CHANGE IN COURSES
MEMORANDUM

TO: Sandra Williams  
Associate Registrar

THROUGH: Kim Dooley  
Associate Dean

FROM: Department of Animal Science  
Dr. David Forrest

SUBJECT: Request to Include Zero Credit Hour in Existing Courses

The College of Agriculture and Life Sciences, Department of Animal Science, requests the following existing courses to be changed to include a zero credit hour option effective 201631. No other changes are being made to the courses.

<table>
<thead>
<tr>
<th>Department Name</th>
<th>Course Number/Title</th>
<th>Existing Credit Hours</th>
<th>Proposed Credit Hours</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Science</td>
<td>ANSC 494 Internship</td>
<td>1-5</td>
<td>0-5</td>
<td>Zero credit option will be used to track student participation in internships</td>
</tr>
<tr>
<td>Animal Science</td>
<td>ANSC 291 Research</td>
<td>1-4</td>
<td>0-4</td>
<td>Zero credit option will be used to track first &amp; second year student participation in undergraduate research</td>
</tr>
<tr>
<td>Animal Science</td>
<td>ANSC 485 Directed Studies</td>
<td>1-4</td>
<td>0-4</td>
<td>Zero credit option will be used to track third &amp; fourth year student participation in directed studies</td>
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<tr>
<td>Animal Science</td>
<td>ANSC 491 Research</td>
<td>1-4</td>
<td>0-4</td>
<td>Zero credit option will be used to track third &amp; fourth year student participation in undergraduate research</td>
</tr>
<tr>
<td>Animal Science</td>
<td>DASC 485 Directed Studies</td>
<td>1-4</td>
<td>0-4</td>
<td>Zero credit option will be used to track third &amp; fourth year student participation in directed studies</td>
</tr>
</tbody>
</table>

109 Kleberg Center  
2471 TAMU  
College Station, TX 77843-2471  
Tel: 979.845.7616 Fax: 979.458.1294  
http://animalscience.tamu.edu
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
- Submit original form and attachments -

Form Instructions
1. Course request type:  
   ✔ Undergraduate  □ Graduate  □ First Professional (D.D.S., M.D., J.D., PharmD., D.V.M.)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
3. Course prefix, number and complete title of course:  
   MSEN 201, Introduction to Materials Science

Attach a brief supporting statement for changes made in items 4d through 9 below.
4. Change requested
   a. Prerequisite(s): From:  
      To:  
   b. Withdrawal (reason):  
   c. Cross-list with:  
      Cross-listed courses require the signature of both department heads.
   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. Attach a course syllabus.
5. Is this an existing core curriculum course?  
   □ Yes  □ No
6. If grade type is changing for existing course, indicate the new grade type:  
   □ Grade  □ S/U  □ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course:
   □ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
8. Complete current course title and current catalog course description:  
   MSEN 201, Introduction to Materials Science  
   Processing, structure, properties and performance in materials; materials structure and defects over many orders of scale; mechanical, thermal, electrical, magnetic and optical properties.

9. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
   MSEN 201, Fundamentals of Materials Science and Engineering  
   Fundamental principles of materials science and engineering, and their application towards complex engineering challenges; relationship between materials structure and functional properties of engineered materials; property-performance relationships; principle classes of materials, as illustrated through key materials advances; current directions in the field.

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
    MSEN 201, Fundamentals of Materials Science and Engineering  
    Fundamental principles of materials science and engineering, and their application towards complex engineering challenges; relationship between materials structure and functional properties of engineered materials; property-performance relationships; principle classes of materials, as illustrated through key materials advances; current directions in the field.

11. a. As currently in course inventory:

<table>
<thead>
<tr>
<th>Prefix</th>
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Approval recommended by:
Ibrahim Karaman  
12/16/2015

Department Head or Program Chair (Type Name & Sign)  
Date  
Chair, College Review Committee  
Date  
Dean of College  
Date  
Chair, GC or UCC  
Date  
Associate Director, Curricular Services  
Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu.
Curricular Services – 08/14
Supporting Statement for item 4d

Title and course description change more accurately reflects course content, which has been modified to be more appropriate for the role of this course in the UG major.
Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
Submit original form and attachments.

Form Instructions
1. Course request type: 
   ☑ Undergraduate  ☐ Graduate  ☐ First Professional (UP, MS, PhD, PhChannel, DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
3. Course prefix, number and complete title of course: MSEN 310, Structure of Materials

4. Change requested
   a. Prerequisite(s): From: To:
   b. Withdrawal (reason):
   c. Cross-list with:
   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. Attach a course syllabus.
5. Is this an existing core curriculum course?
   ☑ Yes  ☐ No
6. If grade type is changing for existing course, indicate the new grade type: ☑ Grade ☐ S/U ☐ P/F (CMG)
7. If this course will be stacked, please indicate the course number of the stacked course:
   ☐ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-control-basics-for-distance-education).
8. Complete current course title and current catalog course description:
   MSEN 310, Structure of Materials
   Symmetry, unit cell and the atomic structure of crystalline and non-crystalline materials; the bonding forces and energy for van der Waals, metallic, ionic and covalent crystals.

9. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
   MSEN 310, Structure of Materials
   Materials structure over many orders of scale; structure of non-crystalline materials; symmetry, unit cell, and the atomic structure of crystalline materials; liquid crystals; structural defects in ordered solids; microstructures and hierarchical structures.

10. As currently in course inventory:

    | Prefix | Course # | Title (excluding punctuation) |
    |--------|----------|-------------------------------|
    | MSEN   | 310      | STRUCTURE OF MATERIALS        |
    |        |          | Lect. Lab Other SCH CIP and Fund Code Admin. Unit HCCE Code Level |
    | 3.00   | 0.00     | 0.00  3.00 4010010002 1864 0 0 3 6 3 2 4 |

   a. Change to:
    
    | Prefix | Course # | Title (excluding punctuation) |
    |--------|----------|-------------------------------|
    |        |          | Lect. Lab Other SCH CIP and Fund Code Admin. Unit Level HCCE Code Year |
    |        |          |                               - 0 0 3 6 3 2 Level |

   Approval recommended by: [Signature]
   Ibrahim Karaman
   Department Head or Program Chair (Type Name & Sign)
   Date
   12/21/2015

   Chair, College Review Committee
   Date
   [Signature]
   12/21/2015

   Dean of College
   Date
   [Signature]
   12/21/2015

   Submitted to Coordinating Board by:
   Chair, GC or UCC
   Date
   [Signature]
   12/21/2015

   Effective Date
   12/21/2015

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu
Curricular Services – 08/14
Supporting Statement for item 4d

Course description change more accurately reflects course content, which has been modified to be more appropriate for the role of this course in the UG major.
Texas A&M University  
Departmental Request for a Change in Course  
Undergraduate • Graduate • Professional  
Submit original form and attachments  

Form Instructions  
1. Course request type:  
   - Undergraduate [✓]  
   - Graduate [ ]  
   - First Professional (MBA, MS, Ed.D, Ph.D, M.D, DO, DPM) [ ]  

2. Request submitted by (Department or Program Name):  
   Department of Materials Science and Engineering  

3. Course prefix, number and complete title of course:  
   MSEN 410, Materials Processing  

4. Change requested:  
   a. Prerequisite(s):  
      From:  
      To:  
   b. Withdrawal (reason):  
   c. Cross-list with:  
   d. Change in course title and description. Enter complete current course title and current course description in item 9, enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.  
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. Attach a course syllabus.  

5. Is this an existing core curriculum course?  
   - Yes [ ]  
   - No [✓]  

6. If grade type is changing for existing course, indicate the new grade type:  
   - Grade [ ]  
   - S/U [ ]  
   - P/F [✓] (CLMD)  

7. If this course will be stacked, please indicate the course number of the stacked course:  
   [ ]  

8. I verify that I have reviewed the FAQ for Export Control Baseline for Distance Education (http://vpr.tamu.edu/resources/export-control/export-control-baselines-for-distance-education).  

9. Complete current course title and current catalog course description:  

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):  

11. a. As currently in course inventory:  

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Approval recommended by:  

Ibrahim Karaman  
Department Head or Program Chair (Type Name & Sign)  
Date: 12/16/2015  
Chair, College Review Committee  
Date  

Chair, Program Chair (Type Name & Sign)  
Date  

(If cross-listed course)  

Submitted to Coordinating Board by:  
Chair, GC or UCC  
Date  

Questions regarding this form should be directed to Sandra Williams at 845-8301 or sandra.williams@tamu.edu  
Curricular Services - 08/14
MSEN 410, Materials Processing,

Credits 3. 2 Lecture Hours, 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:

Dr. Miladin Radovic, Reed McDonald Bldg. 216, mradovic@tamu.edu, 979-865-5114

Course (catalog) description: The course will provide an introduction to synthesis, properties and processing of technologically important inorganic materials (metals and ceramics). Topics covered will include thermodynamics and kinetics of different materials processing methods, casting, deformation processing, heat treatments, powder processing and sintering, coating and thin films processing, etc.

Course Prerequisites: MSEN 201 MSEN 222, AERO 413, BMEN 343, CHEN 313, CVEN 306, ENTC 206, or NUEN 265, or approval of instructor; junior or senior classification.

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Understand basic thermodynamics and kinetics of phase transformations and chemical reactions in materials processing.
2. Describe in details different available conventional methods for processing materials (metals & ceramics) properties and understand their advantages and limitations in terms of final microstructure, cost, energy and power requirements, shape limitations and dimensional tolerances, and time to manufacture components.
3. Select conventional processing method and determine optimal processing parameters to achieve specified microstructure and properties of materials;
4. Understand principles of advanced processing methods and their advantages and limitations.

Required Textbook:

*The Production and Processing of Inorganic Materials*, James W. Evans and Lutgard C. De Jonghe

Related Textbooks:

There are several good textbooks available in the Library covering related course material. In these books, the information covered in the course is approached in different ways and with different perspectives than in required textbook, which may make the principles described easier to understand. In addition, some of the figures and tables in other textbooks may make it easier to understand the topics covered. The following books are recommended, but are not required reading for this course:

*The Science and Engineering of Materials*, Donald R. Askeland, Pradeep P. Fulay, and Wendelin J. Wright

*Materials Processing*, James H. Swisher
Additional Material:

Lecture notes (including topics that are not covered in the required textbook), assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu. Library resources (including supplementary reading material, materials reference handbooks, standards databases and video links) will be available at: http://guides.library.tamu.edu/MSEN410.

Assessment and Evaluation:

Understanding of course material will be evaluated through both conceptual questions and numerical problems in which relevant physical quantities will be calculated from fundamental relationships. Assigned practice problems and Tests will play important roles in gaining a mastery of the course material.

Course Policies and Procedures:

Changes in schedule:

The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Grading Scale (Standard Letter Scale):

A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:

Test#1 (20 %) {Week 5}
Test#2 (20 %) {Week 10}
Test#3 (20 %) {Week 13}
Comprehensive Final (30 %) {End of semester}
Project (10 %)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:

No late work will be accepted, except in the case of an excused absence.

Attendance:

The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located

**Make-up Policy:**

If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence. The reasons absences are considered excused by the university are listed below. See Student Rule 7 for details (http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1) Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2) Death or major illness in a student's immediate family.
3) Illness of a dependent family member.
4) Participation in legal proceedings or administrative procedures that require a student's presence.
5) Religious holy day. NOTE: Prior notification is NOT required.
6) Injury or illness that is too severe or contagious for the student to attend class.
   a. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   b. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence: (i.) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or (ii.) Confirmation of visit to a health care professional affirming date and time of visit.
7) Required participation in military duties.
8) Mandatory admission interviews for professional or graduate school that cannot be rescheduled.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

**Course Outline** (subject to change):

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<td>5</td>
<td>Casting and solidification of metals and glasses;</td>
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<tr>
<td>5</td>
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6 Powders and particles; Productions of powders;
7 Powder compaction;
8 Sintering and densification technologies;
9 Heat treatment and deformation processing of metals;
10 Test 2
10 Coating and Surface Engineering
11 Nanomaterial and Nonmanufacturing
12 Overview of advanced materials processing;
13 Process Engineering
13 Test 3
14 Project presentations
15 Comprehensive Final Exam

*Subject to changes. Changes will be posted on http://ecampus.tamu.edu

** Topic is not covered in the required textbook. Students will be provided with lecture notes and recommendations for additional readings.

Academic Integrity:

Aggie Honor Code: “An Aggie does not lie, cheat, or steal or tolerate those who do.” Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System. For additional information please visit: http://aggiehonor.tamu.edu

Americans with Disabilities Act (ADA) Policy Statement:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
Submit original form and attachments

Form Instructions
1. Course request type: ☑ Undergraduate □ Graduate □ First Professional (Drs. MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
3. Course prefix, number and complete title of course: MESEN 420, Polymer Science

Attach a brief supporting statement for changes made to items 4a, 4b, and 10 below.

4. Change requested:
   a. Prerequisite(s): From: MESEN 201, MESEN 222, AERO 413, BMEN 343, CHEM 313, CHEM 305, EMT 200, or MESEN 265, or approval of Instructor. To: PHYS 208, CHEM 102, CHEM 112, or approval of Instructor.
   b. Withdrawal (reason): ____________________________
   c. Cross-list with: ____________________________

   Cross-listed courses require the signature of both department heads.

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.

   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b.

   f. Attach a course syllabus.

5. Is this an existing core curriculum course? □ Yes □ No

6. If grade type is changing for existing course, indicate the new grade type: □ Grade □ S/U □ P/F (CLMED)

7. If this course will be stacked, please indicate the course number of the stacked course: ____________________________

   I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://or.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

8. Complete current course title and current catalog course description:
   MESEN 420, Polymer Science
   Polymer structure, processing, property characterization at the molecular, microscopic and macroscopic dimensional levels for thermosets, thermoplastics, elastomers, fibers and advanced non-particle filled composites and smart multi-performance structures.

9. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
   MESEN 420, Polymer Science
   Types of polymerization; molecular characteristics of polymer chains; single chain statistics and rubber elasticity; phase transitions, glass transition, viscoelasticity and time-temperature superposition; polymer structure at the molecular, microscopic and macroscopic levels; polymer thermosts, thermoplastics, elastomers, fibers, and advanced nanoparticle-filled composites.

10. Complete course inventory:
   As currently in course inventory:

   Prefix Course # Title (excluding punctuation)
   MESEN 420 POLYMER SCIENCE

   Lect. Lab Other SCH CIP and Fund Code Admin. Unit FICE Code Level
   3.00 0.00 0.00 3.00 4010010002 1864 0 0 3 6 3 2 4

   b. Change to:

   Prefix Course # Title (excluding punctuation)

   Lect. Lab Other SCH CIP and Fund Code Admin. Unit FICE Code Level
   - - - - - - 0 0 3 6 3 2

11. Approval recommended by:

   Ibrahim Karaman ____________________________
   Department Head or Program Chair (Type Name & Sign) Date 12/26/2015

   Chair, College Review Committee ____________________________
   Date ____________________________

   Chair, GC or UCC ____________________________
   Date ____________________________

   Submitted to Coordinating Board by:

   Associate Director, Curricular Services ____________________________
   Date ____________________________

Questions regarding this form should be directed to Sandra Williams at 845-8301 or sandra.williams@tamu.edu.
Curricular Services – 08/14
Supporting Statement for item 4a and 4d

Course prerequisites and description change more accurately reflects course content, which has been modified to be more appropriate for the role of this course in the UG major.
Texas A&M University

Departmental Request for a Change in Course
Undergraduate + Graduate + Professional

* Submit original form and attachments *

**Form Instructions**

1. Course request type:  
   - [ ] Undergraduate  
   - [ ] Graduate  
   - [ ] First Professional (DO, MD, JD, Ph.D., D.P.M.

2. Request submitted by (Department or Program Name):  
Department of Materials Science and Engineering

3. Course prefix, number and complete title of course:  
MSEN 460, Electronic, Optical and Magnetic Properties of Materials

4. Change requested
   a. Prerequisite(s):  
      From:  
      To:  
   b. Withdrawal (reason):  
   c. Cross-list with: 
   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. Attach a course syllabus.

5. Is this an existing core curriculum course?  
   - [ ] Yes  
   - [ ] No

6. If grade type is changing for existing course, indicate the new grade type:  
   - [ ] Grade  
   - [ ] S/U  
   - [ ] P/F (CLMD)

7. If this course will be stacked, please indicate the course number of the stacked course:

8. I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).

9. Complete current course title and current catalog course description:
   MSEN 460 Electronic, Optical and Magnetic Properties of Materials

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
    MSEN 460, Properties of Functional Materials

11. a. As currently in course inventory:

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b. Change to:

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Approval recommended by:

Ibrahim Karaman

[Signature]

12/6/2015

Department Head or Program Chair (Type Name & Sign)  
Date

Chair, College Review Committee  
Date

Dean of College  
Date

Submitted to Coordinating Board by:

Chair, GC or UCC  
Date

Effective Date: 1/21/2015

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu
Curricular Services – 06/14
Supporting Statement for item 4d

Title change is requested to more accurately reflect the breadth of the class.
Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
Submit original form and attachments

Form Instructions
1. Course request type: [ ] Undergraduate [ ] Graduate [ ] First Professional (D.D.S., M.D., M.S., PharmD, D.V.M.)
2. Request submitted by (Department or Program Name): Department of Materials Science and Engineering
3. Course prefix, number and complete title of course: MSEN 485, Directed Studies
4. Change requested
   a. Prerequisite(s): From: ____________________________ To: ____________________________
   b. Withdrawal (reason): ____________________________
   c. Cross-list with: ____________________________
   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. Attach a course syllabus.
5. Is this an existing core curriculum course? [ ] Yes [ ] No
6. If grade type is changing for existing course, indicate the new grade type: [ ] Grade [ ] S/U [ ] P/F (C/L,M,D)
7. If this course will be stacked, please indicate the course number of the stacked course: [ ] I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://var.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
8. Complete current course title and current catalog course description:
   [ ] Credit 1 to 4
   [ ] Credit 0 to 4

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):
   [ ] Credit 1 to 4

11. As currently in course inventory:

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Course #</th>
<th>Title (excluding punctuation)</th>
<th>Lect.</th>
<th>Lab</th>
<th>Other</th>
<th>SCH</th>
<th>CIP and Fund Code</th>
<th>Admin-Unit</th>
<th>FICE Code</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSEN</td>
<td>485</td>
<td>DIRECTED STUDIES</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>1418010006</td>
<td>1864</td>
<td>0 0 3 6 3 2</td>
<td>4</td>
</tr>
</tbody>
</table>

b. Change to:

<table>
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<tr>
<th>Prefix</th>
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<th>Title (excluding punctuation)</th>
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<td>1864</td>
<td>17 18 0 0 3 6 3 2</td>
<td>4</td>
</tr>
</tbody>
</table>

Approval recommended by: [ ] Ibrahim Karahan
[Signature]
Department Head or Program Chair (Type Name & Sign) Date
Chair, College Review Committee
[Signature]
Department Head or Program Chair (Type Name & Sign) Date
Dean of College
[Signature]
Submitted to Coordinating Board by: [ ] Chair, GC or UCC
[Signature]
[Date]
Associate Director, Curricular Services

Questions regarding this form should be directed to Sandra Williams at 845.8320 or sandra.williams@tamu.edu
Curricular Services – 06/14
Supporting Statement for item 4e

Credit hour change is requested to allow the zero-credit hour option for undergraduate directed studies classes.
MSEN 485, Directed Studies
Credits 0-4.

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Patrick Shamberger, Reed McDonald Bldg. 229, patrick.shamberger@tamu.edu, 979-458-1086

Course (catalog) description: Directed study of selected problems in the area of materials science and engineering not covered in other courses. May be taken four times for credit.

Course Prerequisites: Junior or Senior classification, approval of instructor

Learning Outcomes: At the end of this course, students should be able to demonstrate conceptual understanding in the topic area of directed study, as defined by the instructor. Learning outcomes are identified on an individual basis at the outset of the semester.

Textbook: Textbook identified on an individual basis at the outset of the semester.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Course outline identified on an individual basis at the outset of the semester.

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course is evaluated based on submission of directed-study related products, as agreed upon by the student and the faculty instructor at the beginning of the semester. The student is responsible for preparing, and getting instructor approval for the course plan of study, including: 1) Objective of the Directed Studies course, 2) Approach, 3) Expected Outcomes/Deliverables, 4) Weekly Schedule, 5) Grading scheme, and 6) Credit Hour justification.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60
Grading Policies:
Grading scheme is agreed upon by the student and faculty instructor at the onset of the semester.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell-phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student’s immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student’s presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student’s physician. Requests for excused absence related to pregnancy should be directed to the instructor.
Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
Texas A&M University
Departmental Request for a Change in Course
Undergraduate + Graduate + Professional
Submit original form and attachments

Form Instructions
1. Course request type:
   - Undergraduate [✓]
   - Graduate [ ]
   - First Professional (PhD, MD, JD, PharmD, DPA)

2. Request submitted by (Department or Program Name):
   Department of Materials Science and Engineering

3. Course prefix, number and complete title of course:
   MSEN 491, Research

4. Change requested:
   a. Prerequisite(s): From: ___________________________ To: ___________________________
   b. Withdrawal (reason): ___________________________
   c. Cross-list with: ___________________________

   Cross-listed courses require the signature of both department heads.

5. Change in course title and description: Enter complete current course title and current course description in Item 9. Complete item 11a and b for a change in title.
6. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. Attach a course syllabus.
7. Is this an existing core curriculum course? [ ] Yes [ ] No
8. If grade type is changing for existing course, indicate the new grade type: [ ] Grade [ ] S/U [ ] P/F (CLAD)
9. If this course will be stacked, please indicate the course number of the stacked course:
   [ ] I verify that I have reviewed the FAQ for Export Control Issues for Distance Education (https://vpr.tamu.edu/resources/export-contro/)
10. Complete proposed course title and proposed catalog course description (not to exceed 50 words): Credit 1 to 4.
11. Complete current course title and current catalog course description:

   Credit 0 to 4.

   a. As currently in course inventory:

      | Prefix | Course # | Title (excluding punctuation) |
      |--------|----------|-------------------------------|
      | MSEN   | 491      | RESEARCH                      |
      | Lect.  | Lab      | Other | SCH | CIP and Fund Code | Admin. Unit | FLCE Code | Level |
      | 0:00   | 0:00     | 0:00 | 0:00 | 1418010006        | 1864        | 0 0 3 6 3 2 | 4     |

   b. Change to:

      | Prefix | Course # | Title (excluding punctuation) |
      |--------|----------|-------------------------------|
      | MSEN   | 491      | RESEARCH                      |
      | Lect.  | Lab      | Other | SCH | CIP and Fund Code | Admin. Unit | Acad. Year | FLCE Code |
      | 0:00   | 0:00     | 0:00 | 0:00 | 1418010006        | 1864        | 17 18     | 0 0 3 6 3 2 |

   Approval recommended by: ___________________________

   [Signature]

   [Position]

   [Date]

   Department Head or Program Chair (Type Name & Sign) Date

   Chair, College Review Committee Date

   Department Head or Program Chair (Type Name & Sign) Date

   Deans of College Date

   Submitted to Coordinating Board by:

   Chair, GC or UCC Date

   Associate Director, Curricular Services Date

   Questions regarding this form should be directed to Sandra Williams at 845-821-0000 or sandra-williams@tamu.edu

   Curricular Services - 08/14

   RECEIVED DEC 1 6 2015

   CURRICULAR SERVICES
Supporting Statement for item 4e

Credit hour change is requested to allow the zero-credit hour option for undergraduate student researcher
MSEN 491, Research
Credits 0-4.

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Patrick Shamberger; Reed McDonald Bldg. 229, patrick.shamberger@tamu.edu. 979-458-1086

Course (catalog) description: Research conducted under the direction of faculty members in materials science and engineering. May be taken four times for credit.

Course Prerequisites: Approval of instructor

Learning Outcomes: At the end of this course, students should have made significant research progress in the agreed upon area of research, as defined by the instructor. Learning outcomes are identified on an individual basis at the outset of the semester.

Textbook: Textbook identified on an individual basis at the outset of the semester.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Course outline identified on an individual basis at the outset of the semester.

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course is evaluated based on submission of research-related products, as agreed upon by the student and the faculty instructor at the beginning of the semester. The student is responsible for preparing, and getting instructor approval for the course plan of study, including: 1) Objective of the Research, 2) Approach, 3) Expected Outcomes/Deliverables, 4) Weekly Schedule, 5) Grading scheme, and 6) Credit Hour justification.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
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3. Illness of a dependent family member.
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   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.
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January 5, 2016

MEMORANDUM

TO: Sandra Williams  
   Associate Registrar

THROUGH: Dr. Kim Dooley  
   Associate Dean

FROM: Department of Poultry Science  
   Dr. David Caldwell

SUBJECT: Request to Include Zero Credit Hour in Existing Courses

The College of Agriculture and Life Sciences, Department of Poultry Science, requests the following existing courses to be changed to include a zero credit hour option effective 201631. No other changes are being made to the courses.

<table>
<thead>
<tr>
<th>Department Name</th>
<th>Course Number/Title</th>
<th>Existing Credit Hours</th>
<th>Proposed Credit Hours</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poultry Science</td>
<td>POSC 491 Research</td>
<td>1-4</td>
<td>0-4</td>
<td>Zero credit option will be used to track student participation in undergraduate research</td>
</tr>
</tbody>
</table>
Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional

Submit original form and attachments.

Form Instructions
1. Course request type: Undergraduate □ Graduate □ First Professional (DDS, MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name): Department of Educational Administration and Human Resource Development
3. Course prefix, number and complete title of course: TCMG 476 Managing Technical Networks

4. Change requested
   a. Prerequisite(s): From: TCMG 272 and TCMG 274 with a grade of C or better, junior or senior classification. To: TCMG 308 with a grade of C or better or approval of instructor.
   b. Withdrawal (reason):
   c. Cross-list with:

   Cross-listed courses require the signature of both department heads.

   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete items 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete items 11a and b. Attach a course syllabus.

5. Is this an existing core curriculum course? Yes □ No □
6. If grade type is changing for existing course, indicate the new grade type: Grade □ S/U □ P/F (CLMD)
7. If this course will be stacked, please indicate the course number of the stacked course:
   □ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-controls/export-controls-basics-for-distance-education).
8. Complete current course title and current catalog course description:

9. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

11. As currently in course inventory:

<table>
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<th>SCH</th>
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<th>Admin. Unit</th>
<th>HICE Code</th>
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<table>
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<tr>
<th>Level</th>
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<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

   Approval recommended by:

   Department Head or Program Chair (Type Name & Sign) Date: 11/10/2015

   Chair, College Review Committee Date

   Department Head or Program Chair (Type Name & Sign) Date

   Dean of College Date

   Submitted to Coordinating Board by:

   Chair, GC or UCC Date

   Associate Director, Curricular Services Date

   Received Date

Questions regarding this form should be directed to Sandra Williams at 845-8301 or sandra.williams@tamu.edu.
Curricular Services – 08/14

CURRICULAR SERVICES
Program faculty request the change of prerequisite to afford students better opportunities at success in this academic course migrated to the new TCMG prefix during last year’s curricular cycle.
CHANGE IN CURRICULA
CHANGE IN CURRICULUM

COLLEGE OF SCIENCE
DEPARTMENT OF PHYSICS AND ASTRONOMY
BA IN PHYSICS
Texas A&M University  
Request for a Change in Curriculum  
Undergraduate + Graduate + Professional

1. Program request type:  
   - ☑ Undergraduate  
   - □ Graduate  
   - □ First Professional (e.g., DVM, JD, MD, etc.)  
   - ☑ Degree Program  
   - □ Minor  
   - □ Certificate

2. Request change for:  

3. Request submitted by (Department or Program Name):  

4. Program Designation and Name  
   (e.g., B.A. in History, Minor in History, Certificate in European Union):  
   - B.A. in Physics

5. Brief description of change:  
   Remove the requirements of PHYS 444 Art of Communication I and PHYS 445 Art of Communication II from the curriculum. Request that the three hours be delineated as another 3 hour Science and Technical Elective.

6. Rationale for change:  
   PHYS 444 and 445 have been serving to meet the University W/C requirements. PHYS 327 Experimental Physics has been approved to be divided into PHYS 327 Experimental Physics and PHYS 328 Experimental Physics II, as a University W course and a University C course respectively, eliminating the need for PHYS 444 and 445. The hours can be better used as a science and technical elective filled with a course that will aid their path toward their future goals.

7. Use the checkboxes below to make sure that all information is included.  
     - ☑ Yes  
     - □ No
   - b. Current catalog curriculum with handwritten edits attached.  
     - ☑ Yes  
     - □ No
     - ☑ Yes  
     - □ No
   - Please make sure the attached proposed curriculum, catalog and Howdy degree evaluation match.

8. a. Will degree program hours change (increase/decrease) due to the proposed curriculum changes?  
   - □ Yes  
   - ☑ No
   - If yes, degree program hours will change from:  
   - to:  
   - b. If yes, is the Texas Higher Education Coordinating Board form attached?  
     - □ Yes  
     - ☑ No

9. If proposed changes affect other unit(s), are letters of support attached?  
   - □ Yes  
   - ☑ No

IMPORTANT NOTE: Curriculum changes submitted through the approval process and fully approved by February (December-UCC/GC, January-Faculty Senate, February-President) will be effective in the next academic year. Changes requiring approval beyond the University should complete the internal approval process early in the fall semester whenever possible in order to ensure timely implementation.

Approval Recommended By:  

[Handwritten Signature]  
[Date: 12/8/15]  
[Handwritten Signature]  
[Date: 12-10-15]  
[Handwritten Signature]  
[Date: 12/8/15]  

Department Head or Program Chair (Type Name & Sign)  
Date  
Dean of College  
Date  
Chair, College Review Committee  
Date  
Chair, GC or UCC  
Date

Questions regarding this form should be directed to Curricular Services at 845-8201 or sandra.sullins@tamu.edu.
Curricular Services – 04/14
Texas A&M University
Request for a Change in Curriculum
Undergraduate • Graduate • Professional

1. Program request type: □ Undergraduate  □ Graduate  ☑ First Professional (e.g., DVM, JD, MD, etc.)

2. Request change for: □ Degree Program  □ Minor  ☑ Certificate

3. Request submitted by (Department or Program Name):
Program Designation and Name
(Examples: B.A. in History, Minor in History, Certificate in European Union): Physics and Astronomy

4. □ B.A. in Physics

5. Brief description of change:
Change the approved Communication elective from "Any approved Communication course with an ENGL prefix" to "Any approved Communication course."

6. Rationale for change:
In past years, there were 6 choices for the Communication elective with an ENGL prefix. Because there are now 7, we would like to allow students to also choose from the approved Communication electives with a COMM prefix.

Use the checkboxes below to make sure that all information is included.

7. a. Proposed curriculum attached. □ Yes  ☑ No
   b. Current catalog curriculum with handwritten edits attached. □ Yes  ☑ No
   c. Current Howdy degree evaluation with handwritten edits attached. □ Yes  ☑ No
   Please make sure the attached proposed curriculum, catalog and Howdy degree evaluation match.

8. a. Will degree program hours change (increase/decrease) due to the proposed curriculum changes? □ Yes  ☑ No
   b. If yes, degree program hours will change from: ___________ to: ___________
   c. If yes, is the Texas Higher Education Coordinating Board form attached? □ Yes  ☑ No
      http://www.thecb.state.tx.us/index.cfm?objectid=A0F9F7FA-9A92-4F11-2756AD3BBFF91D60

9. If proposed changes affect other unit(s), are letters of support attached? □ Yes  ☑ No

IMPORTANT NOTE: Curriculum changes submitted through the approval process and fully approved by February (December-UCC/GC, January-Faculty Senate, February- President) will be effective in the next academic year. Changes requiring approval beyond the University should complete the internal approval process early in the fall semester whenever possible in order to ensure timely implementation.

Approval recommended by:

[Signature]
Department Head or Program Chair (Type Name & Sign)  12-8-15  Date

[Signature]
Chair, College Review Committee  12-8-15  Date

[Signature]
Dean of College  12-10-15  Date

[Signature]
Chair, GC or UCC  12-10-15  Date

Questions regarding this form should be directed to Curricular Services at 845-8201 or curriculum@c.tamu.edu
Curricular Services – 04/14

RECEIVED CURRICULAR SERVICES 1.5.2015
Texas A&M University
Request for a Change in Curriculum
Undergraduate • Graduate • Professional

1. Program request type:  ☑ Undergraduate  ☐ Graduate  ☐ First Professional (e.g., DVM, JD, MD, etc.)

2. Request change for:  ☑ Degree Program  ☐ Minor  ☐ Certificate

3. Request submitted by (Department or Program Name):  Physics and Astronomy

   Program Designation and Name
   (e.g., B.A. in History, Minor in History, Certificate in European Union):  B.A. in Physics

4. Brief description of change:
   Break PHYS 327 - Experimental Physics (3 hours) into PHYS 327 - Experimental Physics (2 hours) and PHYS 328 - Experimental Physics II (1 hour). These courses have been approved as a Writing course and a Communication course, respectively. These two courses will replace PHYS 444 - Art of Scientific Communication I (2 hours) and PHYS 445 - Art of Scientific Communication II (1 hour) as fulfillment of the major and university writing requirement. Add Upper-Division Science or Technical Elective (3 hours) where PHYS 444 and 445 are removed.

5. Rationale for change:
   PHYS 444 and 445 were created to meet the university W/C requirement, but did not truly meet the spirit of the requirement. PHYS 327, Experimental Physics is a major required course. We request it be split into two courses so the University W/C requirement of two courses will continue to be met. PHYS 327 required very little adjustment to the syllabus, beyond small changes in the grading and in the order of assignments to be approved as PHYS 327 - W and 328 - C. It is designed to prepare students to present at professional physics conferences and write journal quality articles. Removing PHYS 444 and 445 from the curriculum leaves 3 hours open. We ask that this be designated as an upper-division science and technical elective.

6. Use the checkboxes below to make sure that all information is included.

   a. Proposed curriculum attached.  ☑ Yes  ☐ No
   b. Current catalog curriculum with handwritten edits attached.  ☑ Yes  ☐ No
   c. Current Howdy degree evaluation with handwritten edits attached.  ☑ Yes  ☐ No

   Please make sure the attached proposed curriculum, catalog and Howdy degree evaluation match.

7. a. Will degree program hours change (increase/decrease) due to the proposed curriculum changes?  ☐ Yes  ☑ No

   b. If yes, degree program hours will change from:  to:

   c. If yes, is the Texas Higher Education Coordinating Board form attached?  ☐ Yes  ☐ No

   http://www.thecb.state.tx.us/index.cfm?objectid=A0F9F7FA-9A92-4F11-275aAD3BBF301D60

8. a. If proposed changes affect other unit(s), are letters of support attached?  ☐ Yes  ☐ No

   IMPORTANT NOTE: Curriculum changes submitted through the approval process and fully approved by February (December-UCC/GC, January-Faculty Senate, February-President) will be effective in the next academic year. Changes requiring approval beyond the University should complete the internal approval process early in the fall semester whenever possible in order to ensure timely implementation.

   Approval Recommended by:

   [Signature]
   Department Head or Program Chair (Type Name & Sign)  Date
   12/8/15

   [Signature]
   Chair, College Review Committee  Date
   12/8/15

   [Signature]
   Dean of College  Date
   12/10/15

   [Signature]
   Chair, GC or UCC  Date
   DECEMBER 15 2015

   CURRICULAR SERVICES

Questions regarding this form should be directed to Curricular Services at 845.8201 or sandra.palamas@tamu.edu.
Curricular Services - 04/14
Physics - BA

The Bachelor of Arts curriculum provides the student with a firm foundation in physics and with the flexibility to choose from a large number of elective courses, thus permitting the student to explore other interests. Except for those students pursuing teacher certification, some of these elective courses are chosen to satisfy the requirements of a minor field of study. The student can, therefore, customize his or her program of study in preparation for a career in any science-related or science-required field, from intellectual property law and science reporting to physics teaching. Although not required for the BA program, students have the opportunity to become directly involved in any of the active research programs in the Department of Physics and Astronomy.

Program Requirements

First Year

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<th>Semester</th>
<th>Credit Hours</th>
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<td>Fall</td>
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<td>ENGL 104</td>
<td>Composition and Rhetoric</td>
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<td>HIST 105</td>
<td>History of the United States</td>
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<td>MATH 171</td>
<td>Analytic Geometry and Calculus</td>
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<td>PHYS 101</td>
<td>freshman Physics, orientation</td>
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<td>PHYS 218</td>
<td>Mechanics</td>
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<tr>
<td>CHEM 107</td>
<td>General Chemistry for Engineering Students</td>
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<td>&amp; CHEM 117</td>
<td>and General Chemistry for Engineering Students Laboratory</td>
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<td>MATH 172</td>
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<td>PHYS 206</td>
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<td>PHYS 221</td>
<td>Optics and Thermal Physics</td>
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<td>POLS 206</td>
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<td>Advanced Electricity and Magnetism</td>
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Fourth Year

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1 A physics major must complete the foundation courses (PHYS 101, PHYS 102, PHYS 208, PHYS 221, Physics 309, Physics 331, CHEM 107/117, MATH 171, MATH 172, MATH 221, MATH 308) with a grade of C or better and have a 2.0 cumulative GPA before taking non-foundation upper-level physics courses.

2 Any course in this category can be the approved University Core Curriculum list of courses.

3 A minor field must be selected in conjunction with the student's advisor. In addition, 6 hours of courses must be in the area of international and cultural diversity. These may be in addition to University Core Curriculum courses, or if a course in this category satisfies an area of the Core, it can be used to meet both requirements.

4 To register for PHYS 401 a student must be able to program in a high-level language, such as FORTRAN, Java or C. This prerequisite can be satisfied by taking CSCE 206 or the equivalent.

5 Approved W course designation.

6 Any approved Communication course with an ENGL prefix.

7 ASTR 314 or any 400-level physics, science or technical elective.
# Proposed Bachelor of Arts Degree - Catalog 140 (2017 – 2018)

## Freshman Year

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<th>Second Semester</th>
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<td>CHEM 107 Gen. Chem. for Engr. Students</td>
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</tbody>
</table>
Detail Requirements

Information for Degree Evaluation

This is NOT an official evaluation.

**Program Evaluation**

Limitation Correspondence: No more than 12 hours of correspondence earned through an accredited institution may be used for an undergraduate degree.

Limitation Combination: Maximum combination of 18 hours of 481, 482, 485 and/or 491 courses may be used for an undergraduate degree.

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<th>Catalog Term :</th>
<th>Fall 2014 - College Station</th>
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This is NOT an official evaluation.

**Area : Major Coursework ( 41.000 credits ) - Not Met**

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https://compass-ssb.tamu.edu/pls/PROD/bwckapp.P_VerifyDispEvalViewOption

7/6/2015
Detail Requirements

No AND D. PHYS 208
Must make a grade of 'C' or better.

No AND E. PHYS 221
Must make a grade of 'C' or better.

No AND F. PHYS 225

No AND G. PHYS 304

No AND H. PHYS 309
Must make a grade of 'C' or better.

No AND I. PHYS 322
300 level PHYS elective 3 hours (Select from ASMR 300-499, PHYS 400-499, except PHYS 485

No AND J. PHYS 412

No AND K. PHYS 302

No AND L. PHYS 401

No AND M. PHYS 331
Must make a grade of 'C' or better.

No AND N. PHYS 332

Total Credits and GPA 0.000 0.00

unofficial evaluation

Area: Communication (6.000 credits) - Not Met

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Select any ENGL course with the Communication [KCOM] attribute.

Total Credits and GPA 0.000 0.00

unofficial evaluation

Area: Mathematics (15.000 credits) - Not Met

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Must make a grade of 'C' or better.

No AND B. MATH 172

Must make a grade of 'C' or better.

No AND C. MATH 221

### Detail Requirements

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**unofficial evaluation**

### Area: Life and Physical Sciences (4.000 credits) - Not Met

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**unofficial evaluation**

### Area: Language, Philosophy & Culture (3.000 credits) - Not Met

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**unofficial evaluation**

### Area: Creative Arts (3.000 credits) - Not Met

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<th>Required Credits</th>
<th>Required Courses</th>
<th>Term</th>
<th>Subject</th>
<th>Course</th>
<th>Title</th>
<th>Attribute</th>
<th>Credits</th>
<th>Grade</th>
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<tbody>
<tr>
<td>No</td>
<td>A.</td>
<td></td>
<td>Creative Arts Requirement</td>
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<td>Select three hours from any course with the Creative Arts attribute [KCRA].</td>
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</table>

**unofficial evaluation**

Area: Social and Behavioral Sciences (3.000 credits) - Not Met

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<tr>
<th>No</th>
<th>Condition</th>
<th>Rule</th>
<th>Subject</th>
<th>Attribute</th>
<th>Low</th>
<th>High</th>
<th>Required Credits</th>
<th>Required Courses</th>
<th>Term Subject</th>
<th>Course Title</th>
<th>Attribute</th>
<th>Credits</th>
<th>Grade</th>
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<tr>
<td>A.</td>
<td>Social Science Rqmt 3hrs</td>
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<td>Select from courses with the Social and Behavioral Science attribute [KSOC]</td>
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</tbody>
</table>

Total Credits and GPA 0.000 0.00

unofficial evaluation

Area: Citizenship (12.000 credits) - Not Met

Description: Completion of 4 semesters of Upper-Level ROTC may be substituted for 3 hours of American History and 3 hours of Political Science.

<table>
<thead>
<tr>
<th>No</th>
<th>Condition</th>
<th>Rule</th>
<th>Subject</th>
<th>Attribute</th>
<th>Low</th>
<th>High</th>
<th>Required Credits</th>
<th>Required Courses</th>
<th>Term Subject</th>
<th>Course Title</th>
<th>Attribute</th>
<th>Credits</th>
<th>Grade</th>
<th>Source</th>
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<tbody>
<tr>
<td>A.</td>
<td>American History Rqmt 6hrs</td>
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<td>Select from any course with the [KHIS] attribute.</td>
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</table>

| No | AND | B. | Political Science Rqmt 6hrs | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | Take POLS 206 and POLS 207. | | | | | | | | | | | |

Total Credits and GPA 0.000 0.00

unofficial evaluation

Area: Writing Requirement (3.000 credits) - Not Met

Description: This area requires 3 hours of courses with the UWRT attribute.

<table>
<thead>
<tr>
<th>No</th>
<th>Condition</th>
<th>Rule</th>
<th>Subject</th>
<th>Attribute</th>
<th>Low</th>
<th>High</th>
<th>Required Credits</th>
<th>Required Courses</th>
<th>Term Subject</th>
<th>Course Title</th>
<th>Attribute</th>
<th>Credits</th>
<th>Grade</th>
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<td>Writing Requirement</td>
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</tbody>
</table>

Only sections of PHYS 327 with the Writing attribute [UWRT] may be used to satisfy this requirement. Only sections of PHYS 327 with the Writing attribute [UWRT] and sections of COMM 338 with the Communication attribute [C?J may be used.

Total Credits and GPA 0.000 0.00

unofficial evaluation

Area: General Electives (30.000 credits) - Not Met

<table>
<thead>
<tr>
<th>No</th>
<th>Condition</th>
<th>Rule</th>
<th>Subject</th>
<th>Attribute</th>
<th>Low</th>
<th>High</th>
<th>Required Credits</th>
<th>Required Courses</th>
<th>Term Subject</th>
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https://compass-ssb.tamu.edu/pls/PROD/bwckapp.P_VerifyDispEvalViewOption

7/6/2015
### Unofficial Evaluation

<table>
<thead>
<tr>
<th>Area: Work Not Applied - Met</th>
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</thead>
<tbody>
<tr>
<td>Description: See advisor for acceptable substitutions.</td>
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</table>

<table>
<thead>
<tr>
<th>Met</th>
<th>Condition</th>
<th>Rule</th>
<th>Subject</th>
<th>Attribute</th>
<th>Low</th>
<th>High</th>
<th>Required Credits</th>
<th>Required Courses</th>
<th>Term Subject</th>
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<th>Credits</th>
<th>Grade</th>
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<tr>
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<td>A.</td>
<td>Courses not applied</td>
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</table>

| Total Credits and GPA | 0.000 | .00 |

### Unofficial Evaluation

| Area: CLSC BA Required Minor - Not Met |

**Met**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rule</th>
<th>Subject</th>
<th>Attribute</th>
<th>Low</th>
<th>High</th>
<th>Required Credits</th>
<th>Required Courses</th>
<th>Term Subject</th>
<th>Course Title</th>
<th>Attribute</th>
<th>Credits</th>
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<tbody>
<tr>
<td>No</td>
<td>A.</td>
<td>Required Minor</td>
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</tbody>
</table>

Minor requirement not needed if minor requirement is waived by the Dean's Office.

| Total Credits and GPA | 0.000 | .00 |

### Unofficial Evaluation

| Area: University Writing Requirement - Not Met |

**Met**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rule</th>
<th>Subject</th>
<th>Attribute</th>
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<th>High</th>
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<th>Required Courses</th>
<th>Term Subject</th>
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<tbody>
<tr>
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</tbody>
</table>

Two courses required. Only sections of PHIL 337 may be used to satisfy the requirement.

| Total Credits and GPA | 0.000 | .00 |

### Unofficial Evaluation

| Area: Int'l & Cult Diversity - Not Met |

**Met**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rule</th>
<th>Subject</th>
<th>Attribute</th>
<th>Low</th>
<th>High</th>
<th>Term Subject</th>
<th>Course Title</th>
<th>Attribute</th>
<th>Credits</th>
<th>Grade</th>
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https://compass-ssb.tamu.edu/pls/PROD/bwckcapp.PVerifyDispEvalViewOption

7/6/2015
### Detail Requirements

<table>
<thead>
<tr>
<th>No</th>
<th>A.</th>
<th>Int'l &amp; Cultural Diversity 6hr</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Select from courses with the International and Cultural Diversity attribute [UICD] (except sections of BUSN 289 with the UWRT attribute).</td>
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</table>

**Total Credits and GPA**: 0.000 .00

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#### Unofficial Evaluation

**Area**: Foreign Language - Not Met

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<th>Condition</th>
<th>Rule</th>
<th>Subject</th>
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<th>Low</th>
<th>High</th>
<th>Required Credits</th>
<th>Required Courses</th>
<th>Term</th>
<th>Subject</th>
<th>Course</th>
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<th>Credits</th>
<th>Grade</th>
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- Complete one of the following:
  1. Two years of the same foreign language in High School.
  2. A two semester sequence of the same foreign language for University credit.

**Total Credits and GPA**: 0.000 .00

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#### Unofficial Evaluation

**Area**: Residence Requirement - Not Met

<table>
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<tr>
<th>Met</th>
<th>Condition</th>
<th>Rule</th>
<th>Subject</th>
<th>Attribute</th>
<th>Low</th>
<th>High</th>
<th>Required Credits</th>
<th>Required Courses</th>
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<th>Credits</th>
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<td>A.</td>
<td>Residence - Major 12hrs</td>
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<tr>
<td>No</td>
<td>AND</td>
<td>B.</td>
<td>Residence 300-499 24hrs</td>
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**Total Credits and GPA**: 0.000 .00

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#### Unofficial Evaluation

**Area**: GPR-Major - Not Met

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<th>Condition</th>
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<th>Low</th>
<th>High</th>
<th>Required Credits</th>
<th>Required Courses</th>
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<th>Credits</th>
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<td>No</td>
<td>A.</td>
<td>Major GPR 34+hrs</td>
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- Includes PHYS 100-499; ASTR 314.

**Total Credits and GPA**: 0.000 .00

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**Unofficial Evaluation**

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https://compass-ssb.tamu.edu/pls/PROD/bwckcapp.P_VerifyDispEvalViewOption

7/6/2015
CHANGE IN CURRICULUM

COLLEGE OF SCIENCE
DEPARTMENT OF PHYSICS AND ASTRONOMY
BS IN PHYSICS
Texas A&M University
Request for a Change in Curriculum
Undergraduate • Graduate • Professional

1. Program request type: ☑ Undergraduate ☐ Graduate ☐ First Professional (e.g., J.D., M.D., etc.)

2. Request change for: ☑ Degree Program ☐ Minor ☐ Certificate

3. Request submitted by (Department or Program Name):
   Physics and Astronomy

4. Program Designation and Name:
   B.S in Physics

5. Brief description of change:
   Remove the requirements of PHYS 444 Art of Communication I and PHYS 445 Art of Communication II from the curriculum. Request that the three hours be delineated as a 3 hour Physics Elective.

6. Rationale for change:
   PHYS 444 and 445 have been serving to meet the University W/C requirements. PHYS 327 Experimental Physics has been approved to be divided into PHYS 327 Experimental Physics and PHYS 328 Experimental Physics II, as a University W course and a University C course respectively, eliminating the need for PHYS 444 and 445. The hours can be better used as a Physics elective filled with a course that will aid their path toward their future goals.

7. Use the checkboxes below to make sure that all information is included.
   a. Proposed curriculum attached. ☑ Yes ☐ No
   b. Current catalog curriculum with handwritten edits attached. ☑ Yes ☐ No
   c. Current Howdy degree evaluation with handwritten edits attached. ☑ Yes ☐ No

8. Will degree program hours change (increase/decrease) due to the proposed curriculum changes? ☐ Yes ☑ No
   a. If yes, degree program hours will change from: ________ to: ________
   b. If yes, is the Texas Higher Education Coordinating Board form attached?
      http://www.tthecb.state.tx.us/index.cfm?objectid=A0F9F7FA-9A92-4F11-2736AD3BBFF01D60
   c. If yes, is the Texas Higher Education Coordinating Board form included? ☐ Yes ☐ No

9. If proposed changes affect other unit(s), are letters of support attached? ☐ Yes ☑ No

IMPORTANT NOTE: Curriculum changes submitted through the approval process and fully approved by February (December-UCC/GC, January-Faculty Senate, February-President) will be effective in the next academic year. Changes requiring approval beyond the University should complete the internal approval process early in the fall semester whenever possible in order to ensure timely implementation.

Approval recommended by:

George R. Walker
12/17/15
Department Chair or Program Chair (Type Name & Sign) Date

12/21/15
Chair, College Review Committee Date

Dean of College
12/17/15
Date

Chair, GC or UCC
12/21/15
Date

Questions regarding this form should be directed to Curricular Services at 845-8201 or sandra-william@tamu.edu.
Curricular Services – 04/14
Texas A&M University
Request for a Change in Curriculum
Undergraduate • Graduate • Professional

1. Program request type:  ✔Undergraduate  □Graduate  □First Professional (ex. DVM, JD, MD, etc.)

2. Request change for:  ✔Degree Program  □Minor  □Certificate

3. Request submitted by (Department or Program Name):
Program Designation and Name
(e.g. B.A. in History, Minor in History, Certificate in European Union):
Physics and Astronomy
B.S in Physics

4. Brief description of change:
Change the curriculum requirement of PHYS 414 Quantum Mechanics II to either PHYS 414 Quantum Mechanics II or PHYS 416 Solid State Physics.

5. Rationale for change:
PHYS 414 Quantum Physics II is an important class for students who plan to pursue a graduate degree, and is theoretical in nature. As more students are choosing to pursue employment, rather than a graduate degree, the department would like to offer PHYS 416 Solid State Physics, which is more applied in nature. The department feels this either/or requirement will allow students to choose an option that best fits their goals and interests.

Use the checkboxes below to make sure that all information is included.

7. a. Proposed curriculum attached.  ✔Yes  □No
b. Current catalog curriculum with handwritten edits attached.  ✔Yes  □No
c. Current Howdy degree evaluation with handwritten edits attached.  ✔Yes  □No
Please make sure the attached proposed curriculum, catalog and Howdy degree evaluation match.

8. a. Will degree program hours change (increase/decrease) due to the proposed curriculum changes?  □Yes  ✔No
b. If yes, degree program hours will change from: ________ to: ________

c. If yes, is the Texas Higher Education Coordinating Board form attached?  □Yes  □No
http://www.thecb.state.tx.us/index.cfm?objectid=A0F917FA-9A92-411-12756AD3BBF101D60

9. If proposed changes affect other unit(s), are letters of support attached?  □Yes  □No

IMPORTANT NOTE: Curriculum changes submitted through the approval process and fully approved by February (December-ICC GC, January-Faculty Senate, February-President) will be effective in the next academic year. Changes requiring approval beyond the University should complete the internal approval process early in the fall semester whenever possible in order to ensure timely implementation.

Approval recommended by:

Gene Welch  12/8/15

Dean of College

Chair, College Review Committee

RECEIVED
DEC 15 2015

Questions regarding this form should be directed to Curricular Services at 845-8201 or susan.a.williams@tamu.edu.
Curricular Services – 04/14
Texas A&M University
Request for a Change in Curriculum
Undergraduate • Graduate • Professional

1. Program request type: ☑ Undergraduate  ☐ Graduate  ☐ First Professional (e.g., DVM, JD, MD, etc.)

2. Request change for: ☑ Degree Program  ☐ Minor  ☐ Certificate

3. Request submitted by (Department or Program Name):

   Program Designation and Name:

   (e.g., B.A. in History, Minor in History, Certificate in European Union):

   B.S. in Physics

5. Brief description of change:
Change the curriculum requirement of PHYS 491 to either PHYS 491 or ASTR 491.

6. Rationale for change:
All of Bachelor of Science in Physics majors are currently required to complete 4 hours of PHYS 491 research. Students who are interested in pursuing a graduate degree or career in Astronomy prefer to register for ASTR 491. ASTR 491 can also meet a requirement in the Astrophysics degree, which has been declared by many Physics majors. The department considers ASTR 491 and PHYS 491 to be equivalent, and would like to allow students the choice.

7. Use the checkboxes below to make sure that all information is included.

   a. Proposed curriculum attached. ☑ Yes  ☐ No
   b. Current catalog curriculum with handwritten edits attached. ☑ Yes  ☐ No
   c. Current Howdy degree evaluation with handwritten edits attached. ☑ Yes  ☐ No

   Please make sure the attached proposed curriculum, catalog and Howdy degree evaluation match.

8. a. Will degree program hours change (increase/decrease) due to the proposed curriculum changes? ☐ Yes  ☑ No
   b. If yes, degree program hours will change from: _______ to: _______
   c. If yes, is the Texas Higher Education Coordinating Board form attached? ☐ Yes  ☐ No

http://www.thecb.state.tx.us/index.cfm?objectid=A0F9F7EA-9A92-F11-2756-AD3BBFF701D60

9. If proposed changes affect other unit(s), are letters of support attached? ☐ Yes  ☐ No

IMPORTANT NOTE: Curriculum changes submitted through the approval process and fully approved by February (Decemter-UCC/GC, January-Faculty Senate, February-President) will be effective in the next academic year. Changes requiring approval beyond the University should complete the internal approval process early in the fall semester whenever possible in order to ensure timely implementation.

Approval recommended by:

[Signatures]

Department Head or Program Chair (Type Name & Sign)  Date  Dean of College  Date

Chair, College Review Committee  Date  Chair, GC or UCC  Date

Questions regarding this form should be directed to Curricular Services at 845-8201 or sandra.williams@tamu.edu.
Curricular Services – 04/14
Texas A&M University
Request for a Change in Curriculum
Undergraduate • Graduate • Professional

1. Program request type:  
   ✔ Undergraduate  □ Graduate  □ First Professional (e.g., DVM, JD, MD, etc.)

2. Request change for:  
   ✔ Degree Program  □ Minor  □ Certificate

3. Request submitted by (Department or Program Name):  
   Physics and Astronomy

   Program Designation and Name  
   (e.g., B.A. in History, Minor in History, Certificate in European Union):  
   B.S in Physics

4. Brief description of change:  
   Change the approved Communication elective from "Any approved Communication course with an ENGL prefix" to "Any approved Communication course."

5. Rationale for change:  
   In past years, there were 6 choices for the Communication elective with an ENGL prefix. Because there are now two, we would like to allow students to also choose from the approved Communication electives with a COMM prefix.

Use the checkboxes below to make sure that all information is included.

7. a. Proposed curriculum attached.  
   ✔ Yes  □ No

   b. Current catalog curriculum with handwritten edits attached.  
   ✔ Yes  □ No

   c. Current Howdye degree evaluation with handwritten edits attached.  
   ✔ Yes  □ No

   Please make sure the attached proposed curriculum, catalog and Howdye degree evaluation match.

8. a. Will degree program hours change (increase/decrease) due to the proposed curriculum changes?  
   □ Yes  ✔ No

   b. If yes, degree program hours will change from:  
   □ Yes  □ No

   c. If yes, is the Texas Higher Education Coordinating Board form attached?  
   □ Yes  □ No

http://www.thecb.state.tx.us/index.cfm?objectid=A0F9F7FA-9A92-4F11-2756AD3BBEF01D60

9. If proposed changes affect other unit(s), are letters of support attached?  
   □ Yes  □ No

IMPORTANT NOTE: Curriculum changes submitted through the approval process and fully approved by February (December-UCC/SC, January-Faculty Senate, February-President) will be effective in the next academic year. Changes requiring approval beyond the University should complete the internal approval process early in the fall semester whenever possible in order to ensure timely implementation.

Approval recommended by:

SIGNED

Department Head or Program Chair (Type Name & Sign)  Date

Dean of College  Date

Chair, College Review Committee  Date

Chair, GC or UCC  Date

Questions regarding this form should be directed to Curricular Services at 845-8201 or sandra.williams@chembio.tamu.edu
Curricular Services – 04/14
Texas A&M University
Request for a Change in Curriculum
Undergraduate • Graduate • Professional

1. Program request type: ☑ Undergraduate ☐ Graduate ☐ First Professional (ex. DVM, JD, MD, etc.)

2. Request change for: ☑ Degree Program ☐ Minor ☐ Certificate

3. Request submitted by (Department or Program Name): Physics and Astronomy

Program Designation and Name
(e.g., B.A. in History, Minor in History, Certificate in European Union):

B.S. in Physics

4. Brief description of change:
Break PHYS 327 - Experimental Physics (3 hours) into PHYS 327 - Experimental Physics (2 hours) and PHYS 328 - Experimental Physics II (1 hour). These courses have been approved as a Writing course and a Communication course, respectively. These two courses will replace PHYS 444 - Art of Scientific Communication I (2 hours) and PHYS 445 - Art of Scientific Communication II (1 hour) as fulfillment of the major and university writing requirement. Add Upper-Division Science or Technical Elective (3 hours) where PHYS 444 and 445 are removed.

5. Rationale for change:
PHYS 444 and 445 were created to meet the university W/C requirement, but did not truly meet the spirit of the requirement. PHYS 327, Experimental Physics is a major required course. We request it be split into two courses so the University W/C requirement of two courses will continue to be met. PHYS 327 required very little adjustment to the syllabus, beyond small changes in the grading and in the order of assignments to be approved as PHYS 327 - W and 328 - C. It is designed to prepare students to present at professional physics conferences and write journal quality articles. Removing PHYS 444 and 445 from the curriculum leaves 3 hours open. In order to allow students a bit more flexibility in the degree, we ask that this be designated as an upper-division science and technical elective (the degree will then have two).

Use the checkboxes below to make sure that all information is included.

7. a. Proposed curriculum attached. ☑ Yes ☐ No

7. b. Current catalog curriculum with handwritten edits attached. ☑ Yes ☐ No

7. c. Current Howdy degree evaluation with handwritten edits attached. ☑ Yes ☐ No

Please make sure the attached proposed curriculum, catalog and Howdy degree evaluation match.

8. a. Will degree program hours change (increase/decrease) due to the proposed curriculum changes? ☐ Yes ☑ No

8. b. If yes, degree program hours will change from: _________ to: _________

8. c. If yes, is the Texas Higher Education Coordinating Board form attached? ☑ Yes ☐ No

http://www.thecb.state.tx.us/index.cfm?objectid=A0F9E7FA-0A92-4F11-275AAD3BB1F901DBC

9. If proposed changes affect other unit(s), are letters of support attached? ☐ Yes ☑ No

IMPORTANT NOTE: Curriculum changes submitted through the approval process and fully approved by February (December-UCC/GC, January-Faculty Senate, February-President) will be effective in the next academic year. Changes requiring approval beyond the University should complete the internal approval process early in the fall semester whenever possible in order to ensure timely implementation.

Approved Recommended by:

[Signature]
[Name]
[Date]

Department Head or Program Chair (Type Name & Sign)
Date

Dean of College
Date

[Signature]
[Name]
[Date]

Chair, College Review Committee
Date

Chair, GC or UCC
Date

Questions regarding this form should be directed to Curricular Services at 845-8201 or sunda.williams@tamu.edu
Curricular Services - 04/14

RECEIVED DEB 15 2015 CURRICULAR SERVICES
# Physics - BS

The Bachelor of Science curriculum is more rigorous in its physics and mathematics course requirements and is designed primarily for students who wish to pursue an advanced degree in physics or employment as a professional physicist in an industrial setting. Because physics forms the basis of many other sciences such as chemistry, material science, oceanography, nanotechnology, and geophysics, the BS program is an excellent preparation for advanced degrees in these fields. In addition, physicists are increasingly applying their talents to molecular biology, biochemistry, and medicine. An important part of the BS program is student participation in experimental or theoretical research with physics and astronomy faculty.

## Program Requirements

### First Year

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<th>Course Title</th>
<th>Credit Hours</th>
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<td>MATH 171</td>
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<td>PHYS 218</td>
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<td>PHYS 331</td>
<td>Theoretical Methods for Physicists I</td>
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<td>PHYS 327</td>
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### Fourth Year

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<td>PHYS 444</td>
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### Total Semester Credit Hours: 120

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1. A physics major must complete the foundation courses (PHYS 101, PHYS 102, PHYS 208, PHYS 218, PHYS 221, PHYS 309, CHEM 107/117, MATH 171, MATH 172, MATH 221, MATH 308) with a grade of C or better and have a 2.0 cumulative GPR before taking non-foundation upper-level physics courses.

2. Any approved Communication course may be substituted for ENGL 104.

3. Electives should be chosen in consultation with the student's advisor. If the student has not fulfilled the six hour international and cultural diversity Graduation requirement with courses used to meet areas of the Core, they must fulfill this requirement with six of their elective hours.

4. To register for PHYS 401 a student must be able to program in a high level language, such as FORTRAN, Java or C. This prerequisite can be satisfied by taking CSCE 206 or the equivalent.

5. ASTR 314 or any 400-level physics, science or technical elective, except the writing intensive courses, PHYS 444 and PHYS 445.
Approved W course designation.

Maximum combination of 18 hours of 481, 482, 485 and/or 491.

Any 300- or 400 level ASTR or PHYS elective.
Detail Requirements

Information for Degree Evaluation

This is NOT an official evaluation.

Program Evaluation

Limitation Correspondence: No more than 12 hours of correspondence earned through an accredited institution may be used for an undergraduate degree.

Limitation Combination: Maximum combination of 18 hours of 481, 482, 485 and/or 491 courses may be used for an undergraduate degree.

Program: BS PHYS
Campus: College Station
College: Science
Degree: Bachelor of Science
Level: Undergraduate
Majors: Physics
Departments: Physics and Astronomy

Catalog Term: Fall 2014 - College Station
Evaluation Term: Summer 2015 - College Station
Expected Graduation Date: Summer 2015
Request Number: 3
Results as of: Jul 06, 2015
Minors:
Concentrations:

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Program GPA:
Yes .00 .00

Overall GPA:
No 2.00 .00

Other Course Information

Transfer:
0.000 0

This is NOT an official evaluation.

Area: Major Coursework (65.000 credits) - Not Met

Met Condition Rule Subject Attribute Low High Required Credits Required Courses Term Subject Course Title Attribute Credits Grade Source
No A. PHYS 101 Must make a grade of 'C' or better.
No AND B. PHYS 102 Must make a grade of 'C' or better.
No AND C. PHYS 218 Must make a grade of 'C' or better.
Detail Requirements

No AND D. PHYS 208
Must make a grade of 'C' or better.
No AND E. PHYS 221
Must make a grade of 'C' or better.
No AND F. PHYS 225
No AND G. PHYS 304
No AND H. PHYS 305
No AND I. PHYS 309
Must make a grade of 'C' or better.

No AND J. PHYS 497
No AND K. PHYS 412
No AND L. PHYS 408
No AND M. PHYS 414
No AND N. PHYS 425
No AND O. PHYS 426
No AND P. PHYS 302
No AND Q. PHYS 401
No AND R. PHYS 491 (4hrs) /ASTR 491
No AND S. 300-Level PHYS Elect 3hrs
Select from ASTR 300-499, PHYS 300-499 (except PHYS 420, 444, 445, 485, 494).
No AND T. PHYS 303
No AND U. PHYS 331
Must make a grade of 'C' or better.
No AND V. PHYS 332

unofficial evaluation

Area: Communication (6,000 credits) - Not Met

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<td>No  AND</td>
<td>B.</td>
<td>Writing Rqmt 3hrs</td>
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Select any ENGL course with the Communication [KCOM] attribute.

unofficial evaluation

Total Credits and GPA 0.000 .00

### Mathematics (15.000 credits) - Not Met

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**Total Credits and GPA** 0.000 .00

#### Unofficial Evaluation

### Life and Physical Sciences (4.000 credits) - Not Met

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#### Unofficial Evaluation

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**Total Credits and GPA** 0.000 .00

#### Unofficial Evaluation

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Area: Creative Arts (3.000 credits) - Not Met

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Total Credits and GPA 0.000 0.00

unofficial evaluation

Area: Social and Behavioral Sciences (3.000 credits) - Not Met

<table>
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<tr>
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<th>Rule</th>
<th>Subject</th>
<th>Attribute</th>
<th>Low</th>
<th>High</th>
<th>Required Credits</th>
<th>Required Courses</th>
<th>Term Subject</th>
<th>Course Title</th>
<th>Attribute</th>
<th>Credits</th>
<th>Grade</th>
<th>Source</th>
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<tbody>
<tr>
<td></td>
<td>A.</td>
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<td>Social Science Rqmt 3hrs</td>
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<td>Select from courses with the Social and Behavioral Science attribute (KSOC).</td>
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</table>

Total Credits and GPA 0.000 0.00

unofficial evaluation

Area: Citizenship (12.000 credits) - Not Met

Description: Completion of 4 semesters of Upper-Level ROTC may be substituted for 3 hours of American History and 3 hours of Political Science.

<table>
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<tr>
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<th>Subject</th>
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<th>Required Courses</th>
<th>Term Subject</th>
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<td>Select from any course with the [KHIS] attribute.</td>
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<td></td>
<td>AND</td>
<td>B.</td>
<td>Political Science Rqmt 6hrs</td>
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<td>Take POLS 206 and POLS 207.</td>
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Total Credits and GPA 0.000 0.00

unofficial evaluation

Area: Writing Requirement (3.000 credits) - Not Met

Description: This area requires 3 hours of courses with the UWRT attribute.

<table>
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<th>Required Courses</th>
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<tbody>
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<td>Writing Requirement</td>
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<td></td>
<td>Only sections of sections with the Writing attribute [UWRT] may be used to satisfy this requirement, and this box with the Communication attribute C.1 may be used.</td>
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Total Credits and GPA 0.000 0.00

unofficial evaluation

### Unofficial Evaluation

**Area:** General Electives (6.000 credits) - Not Met

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Select any 100-499 course not used elsewhere. (expt AERS 100-299; MATH 100-120, 130-150, 165-166, 365-366; MLSC 100-299; NVSC 100-299; PHYS 201-202, 207-208.)

### Unofficial Evaluation

**Area:** Work Not Applied - Met

**Description:** See advisor for acceptable substitutions.

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<th>Attribute</th>
<th>Low</th>
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<th>Required Credits</th>
<th>Required Courses</th>
<th>Term</th>
<th>Subject</th>
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<th>Credits</th>
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### Unofficial Evaluation

**Area:** University Writing Requirement - Not Met

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<th>Required Courses</th>
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Two courses required. Only sections of PHYS 207 with the Writing attribute (UWRT) may be used to satisfy the requirement. All sections of PHYS 388 with the Communication attribute may be used.

### Unofficial Evaluation

**Area:** Int'l & Cult Diversity - Not Met

<table>
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<th>Attribute</th>
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<th>High</th>
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<th>Required Courses</th>
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https://compass-ssb.tamu.edu/pls/PROD/bwckcapp.P_VerifyDispEvalViewOption  
7/6/2015
### Detail Requirements

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<th>No</th>
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<th>Int'l &amp; Cultural Diversity 6hr</th>
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<td></td>
<td>Select from courses with the International and Cultural Diversity attribute [UICD] (except sections of BUSN 289 with the UWRT attribute).</td>
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</table>

| Total Credits and GPA | 0.000 | .00 |

#### unofficial evaluation

### Area: Foreign Language - Not Met

<table>
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<th>Condition</th>
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<th>Subject</th>
<th>Attribute</th>
<th>Low</th>
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<th>Required Courses</th>
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<tr>
<td></td>
<td>Complete one of the following:</td>
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<tr>
<td></td>
<td>1. Two years of the same foreign language in High School.</td>
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<tr>
<td></td>
<td>2. A two semester sequence of the same foreign language for University credit.</td>
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| Total Credits and GPA | 0.000 | .00 |

#### unofficial evaluation

### Area: Residence Requirement - Not Met

<table>
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<tr>
<th>Met</th>
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<th>Low</th>
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<th>Required Courses</th>
<th>Term</th>
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<th>Course Title</th>
<th>Attribute</th>
<th>Credits</th>
<th>Grade</th>
<th>Source</th>
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<tbody>
<tr>
<td>No</td>
<td>A. Residence - Major 12hrs</td>
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<td>No</td>
<td>AND B. Residence 300-499 24hrs</td>
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| Total Credits and GPA | 0.000 | .00 |

#### unofficial evaluation

### Area: GPR-Major - Not Met

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<th>Required Courses</th>
<th>Term</th>
<th>Subject</th>
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<th>Attribute</th>
<th>Credits</th>
<th>Grade</th>
<th>Source</th>
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<tbody>
<tr>
<td>No</td>
<td>A. Major GPR 34+hrs</td>
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<tr>
<td></td>
<td>Includes PhYS 100-499, ASTR 314.</td>
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| Total Credits and GPA | 0.000 | .00 |

#### unofficial evaluation

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https://compass-ssb.tamu.edu/pls/PROD/bwckapp.P_VerifyDispEvalViewOption

7/6/2015
# Proposed Bachelor of Science Degree –Catalog 140 (2017 – 2018)

## Freshman Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>(Th-Pr)</th>
<th>Cr</th>
<th>Second Semester</th>
<th>(Th-Pr)</th>
<th>Cr</th>
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<tbody>
<tr>
<td>ENGL 104 Comp. and Rhetoric</td>
<td>(3-0)</td>
<td>3</td>
<td>CHEM 107 Gen. Chem. for Engr. Students¹</td>
<td>(3-0)</td>
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<tr>
<td>HIST 105 History of the U.S.²</td>
<td>(3-0)</td>
<td>3</td>
<td>CHEM 117 Gen. Chem. for Engr. Lab¹</td>
<td>(0-1)</td>
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<tr>
<td>MATH 171 Analytic Geom. and Calculus¹</td>
<td>(4-0)</td>
<td>4</td>
<td>HIST 106 History of the U.S.²</td>
<td>(3-0)</td>
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<tr>
<td>PHYS 101 Topics in Cont. Physics¹</td>
<td>(1-0)</td>
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<td>MATH 172 Calculus¹</td>
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<tr>
<td>PHYS 218 Mechanics¹</td>
<td>(3-3)</td>
<td>4</td>
<td>PHYS 102 Topics in Cont. Physics¹</td>
<td>(1-0)</td>
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<tr>
<td></td>
<td></td>
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<td>PHYS 208 Electricity and Optics¹</td>
<td>(3-3)</td>
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## Sophomore Year

<table>
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<th>Second Semester</th>
<th>(Th-Pr)</th>
<th>Cr</th>
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<tbody>
<tr>
<td>MATH 221 Several Variable Calculus¹</td>
<td>(4-0)</td>
<td>4</td>
<td>PHYS 225 Electronic Circuits</td>
<td>(3-3)</td>
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<tr>
<td>MATH 308 Differential Equations¹</td>
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<td>3</td>
<td>PHYS 309 Modern Physics¹</td>
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<tr>
<td>PHYS 221 Optics and Thermal Physics¹</td>
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<td>3</td>
<td>PHYS 331 Theoretical Methods I¹</td>
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<td>POLS 206 American Nat'l. Govt.</td>
<td>(3-0)</td>
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<td>POLS 207 State &amp; Local Govt.</td>
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<tr>
<td>Language, Philosophy and Culture elective²</td>
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<td>Communication elective²</td>
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## Junior Year

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<th>Second Semester</th>
<th>(Th-Pr)</th>
<th>Cr</th>
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<tbody>
<tr>
<td>PHYS 302 Adv. Mechanics I</td>
<td>(3-0)</td>
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<td>PHYS 303 Adv. Mechanics II</td>
<td>(3-0)</td>
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<tr>
<td>PHYS 304 Adv. Elect. and Magn. I</td>
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<td>PHYS 305 Adv. Elec. and Magn. II</td>
<td>(3-0)</td>
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<tr>
<td>PHYS 332 Theoretical Methods II</td>
<td>(3-0)</td>
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<td>PHYS 327 Experimental Physics³</td>
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<tr>
<td>Social and Behavioral Sciences elective²</td>
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<td>PHYS 328 Experimental Physics II³</td>
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<tr>
<td>Creative Arts elective²</td>
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<td>PHYS 412 Quantum Mechanics I</td>
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## Senior Year

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<th>(Th-Pr)</th>
<th>Cr</th>
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<tr>
<td>PHYS 408 Thermo. and Stat. Mechanics</td>
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<td>4</td>
<td>PHYS 401 Computational Physics⁵</td>
<td>(3-0)</td>
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<tr>
<td>PHYS 414 Quantum Mechanics II</td>
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<td>PHYS 425 Physics Lab</td>
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<tr>
<td>PHYS 426 Physics Lab</td>
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<td>PHYS 491/ASTR 491 Research</td>
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<tr>
<td>Physics elective⁶</td>
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<td></td>
<td>Science or Technical elective⁶</td>
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<td>PHYS 491/ASTR 491 Research</td>
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<td>Electives⁴</td>
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</table>

### Notes:

1. A physics major must complete the foundation courses (PHYS 101, 102, 218, 208, 221, 309, 331, CHEM 107/115, MATH 171, 172, 221, 308) with a grade of 'C' or better and have a 2.0 cumulative GPR before taking non-foundation upper-level physics courses.
2. Any course in this category from the approved University Core Curriculum list of courses.
3. Any approved communication course prefix.
4. Electives should be chosen in consultation with the student’s academic advisor. If a student has not fulfilled the 6 hours international and cultural diversity requirement of the University Core Curriculum with courses used to meet other areas of the Core, they must fulfill this requirement with their elective hours.
5. To register for PHYS 401 a student must be able to program in a high level language, such as C or C++. This prerequisite can be satisfied by taking CSCE 206 or the equivalent.
6. ASTR 314 or any 400-level physics, science or technical elective.
7. PHYS 327 is an approved W course. PHYS 328 is an approved C course.
8. Any 300 or 400 level ASTR or PHYS elective.
Special Consideration
SPECIAL CONSIDERATION

DWIGHT LOOK COLLEGE OF ENGINEERING
DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING
BS IN MATERIALS SCIENCE AND ENGINEERING
REQUEST FOR A NEW DEGREE PROGRAM
Dear Dr. Karaman:

I would like to strongly support the adoption of the proposed new Bachelor of Science (B.S.) degree program in Materials Science and Engineering at Texas A&M University. This degree would greatly advance the University’s efforts towards increasing research, undergraduate and graduate education in the field of materials science and engineering to the benefit of students, the University, the State of Texas, the nation, and society in general. It is envisioned that the program will be a key problem-solving education entity that produces highly competent workforce and leaders for the industry, research institutions, and in academia.

To further the development and advancement of new materials discovery and innovations, traditional science and engineering fields alone are inadequate. Materials Science and Engineering is inherently interdisciplinary; therefore, this B.S. degree was designed jointly by faculty in the College of Engineering and the College of Science. The new degree program will benefit from a network of quality experimental facilities and internationally recognized researchers and educators in two colleges, the Dwight Look College of Engineering and the College of Science.

The U.S. Bureau of Labor Statistics’ (BLS) 2012 to 2022 Employment Projections Report indicates a 16.4 percent growth for material scientists and engineers in the State of Texas. Although many Texas industries are “materials-intensive,” there is no undergraduate materials science and engineering program in either of the flagship public universities. Again, according to the BLS report, about 10% of the projected new jobs in materials science and engineering will be located in Texas, however, the current undergraduate programs in Texas only educate 2% of the national B.S. graduates in materials science and engineering. Planning for the future necessitates providing a workforce educated in the research, development, and fabrication of sophisticated materials to serve the “materials-intensive” industry, which promise to be responsible for a large share of the future growth of the Texas economy.

In Texas, only three universities, the University of Texas at El Paso, University of North Texas, and Rice University offer ABET-accredited materials science and engineering undergraduate curriculum. In contrast, there are seven ABET-accredited materials programs in California, six in Pennsylvania, and six in Ohio. Without established departments focusing on MSEN, Texas is short-changing its talented prospective scientists and engineers, by not addressing the future workforce needs of the state and failing to attract good students from both inside and outside the state in this critical area.
The B. S. degree program has been purposely designed by faculty in the College of Science and faculty in the College of Engineering to encompass both traditional materials areas and new emerging fields. The education and training of a B.S. materials science and engineering graduate requires a curriculum with solid foundations in mathematics, chemistry and physics. Furthermore, developing MSEN B.S. graduates for the future requires flexibility in academic preparation to keep pace with emerging sciences and industries such as energy materials, nano and bio materials, and nanotechnologies to meet the challenges of many industries present in Texas such as: aerospace, petrochemical, biomedical, computer, electronics, and telecommunications. Upon establishment, this program will produce Bachelor of Science graduates who will provide these industrial employers with leading-edge expertise in materials.

Summarizing, the College of Science is committed to the establishment of this new undergraduate degree program in Materials Science and Engineering and to providing the support to implement the new program. If I can provide any additional help with this effort, please feel free to contact me.

Sincerely,

Megan Aronson, Ph.D.
Dean
College of Science

Email: maronson@physics.tamu.edu
Office Tel: 1-979-845-2629
Texas A&M University
New Certificate, Bachelors, Masters, or Doctoral Program
Undergraduate • Graduate • Professional
• Proposal Checklist •

Program request type:  ☑ Undergraduate  ☐ Graduate  ☐ First Professional (e.g., DVM, JD, MD, etc.)
Requested by the Department or Unit of:  Department of Materials Science and Engineering

Program Type, Level, Designation, Title, Description, Hours
Program Type:  ☐ Certificate Program  ☑ Degree Program
Program Level:  ☐ UG Certificate  ☐ Grad Certificate  ☑ Bachelor  ☐ Master  ☐ Doctoral  ☐ Professional
Degree Designation (i.e., BS, BA, MA, MS, M4gr, MEA, PhD, EdD, etc.)  B.S.
Title of proposed program:  Materials Science and Engineering
Proposed CIP Code (if known):  14.1801

Brief program description (provide a catalog description for undergraduate and graduate certificates):
Materials science and engineering is an interdisciplinary field that centers on understanding the physical properties of matter, and producing materials with specific characteristics to serve a desired function.

Materials scientists study the connections between material synthesis/processing, matter's underlying structure, and the properties and performance provided by the structure.

Materials engineers develop materials and manufacturing techniques and integrate these materials into commercial products.

Practicing materials scientists and engineers utilize different processing, characterization, modeling, and simulation techniques to solve fundamental materials challenges and enable new materials, devices, and technologies.

Materials Science and Engineering is inherently interdisciplinary; therefore, this degree was designed jointly by faculty in the College of Engineering and the College of Science. The proposed program also complements the existing M.S., M.Eng. and Ph.D. degrees in Materials Science and Engineering at Texas A&M University.

Materials scientists and engineers play crucial roles in nearly all industry sectors, including energy, defense and homeland security, biomedicine, electronics, transportation, infrastructure, and personal care products. The proposed B.S. degree will allow students to obtain a customized learning experience including computational materials science, polymers and soft materials, corrosion engineering, materials design / processing / characterization / simulation, and advanced structural materials. Students may have opportunities to participate in study abroad programs, industrial internships, and undergraduate research or entrepreneurship opportunities.

MSEN B.S. graduates will be prepared to pursue careers as materials engineers and scientists, pursue advanced graduate study, or to apply their knowledge in other areas such as law, medicine or business. Graduates from our department will have the following skills:

- Bridge the gap between fundamental research (science) and technology (engineering),
- Apply fundamental materials processing, structure, properties, and performance relationships to identify and solve materials-related challenges,
Texas A&M University
New Certificate, Bachelors, Masters, or Doctoral Program
Undergraduate • Graduate • Professional
• Proposal Checklist •
• Master a broad suite of synthesis, characterization, and simulation techniques,
• Thrive in multidisciplinary engineering environments,
• Advance as future leaders in specific materials science and engineering areas.

The MSEN B.S. degree program will seek accreditation from ABET at the appropriate time. Guidance and academic advising will be provided through the Department of Materials Science and Engineering.

Minimum program semester credit hours (SCH) Certificates - 12 hours* Bachelors - 120 hours Masters - 30 hours
Proposed program hours: 128

*12 hours minimum to appear on transcript

Certificate Programs □ Embedded □ Standalone
Students take coursework that will result in a degree and certificate being earned at the same time.
Non-degree seeking students take coursework to earn a certificate only (no degrees are awarded).

Off-Campus or Distance Delivery
% of Program a student can take off-campus or through Distance Education

Program Start Date SACSCOC Approval** When Provost needs to inform SACSCOC
□ 25% Notification Only 6 months before first day of program
□ 50%
□ 80%
□ 100%

**Notification letter arranged through the Vice Provost for Academic Affairs and sent by TAMU President.

Program Delivery Mode

☑ On-campus Location College Station/Main Campus
□ Broadcast / TVN
□ Specific off-campus location***
□ Distance Education / Internet □ In-State □ Out-of-State Start Date
□ Out-of-Country

Will this program be offered with another institution? □ Yes □ No
If yes, contact the Vice Provost for Academic Affairs for additional reporting requirements.

***Is this an approved SACSCOC location? □ Yes □ No If no, a program prospectus must be sent to SACSCOC. Approved locations as of March 2012: TAMU-Galveston, TAMU-Qatar, University Center-The Woodlands, CityCentre-Houston, Dubai and Saudi Arabia.

Program Funding
Has program funding been finalized at the department or college level? ☑ Yes □ No
If no, explain or attach budget: ______

Will new costs for the first five years of the program be under $2 million? □ Yes ☑ No
If new costs exceed $2 million, coordinating board approval is required.

Proposal Checklist

Page 2
Revised 04.11.2014
Submitted by (Contact Person):
Dr. Ibrahim Karaman
Name
Professor and Head, Department Materials Science and Engineering
Title
ikaraman@tamu.edu
Email
979-862-3923
Phone

Certification Statement
By signing below, the Dean of the College certifies the proposed program complies with coordinating board standards. If the program is delivered through Distance Education, the Dean of the College certifies that they are following the Principles of Good Practice for Academic Degree and Certificate Programs and Credit Courses Offered Electronically.

Signature, Department Head or Interdisciplinary Program Chair 12/16/2015

Dr. Ibrahim Karaman, Head, Department of Materials Science and Engineering
Texas A&M University

Chair, College Review Committee
Dr. Valerie Taylor
Senior Associate Dean for Academic Affairs
Dwight Look College of Engineering
Texas A&M University

Dean of College
Dr. Katherine Banks
Vice Chancellor and Dean of Engineering
Texas A&M University
Director, Texas A&M Engineering Experiment Station

Date

Dr. Timothy P. Scott
Chair, University Curriculum Committee
Texas A&M University

Date

Additional Approvals Required. Faculty Senate and President.
Agenda Item No.________

AGENDA ITEM BRIEFING

Submitted by: Michael K. Young, President/CEO
Texas A&M University

Subject: Approval of a New Bachelor of Science Degree Program with a Major in Field of Study in Materials Science and Engineering and Authorization to Request Approval from the Texas Higher Education Coordinating Board

Proposed Board Action:

Approve the establishment of a new degree program at Texas A&M University leading to a Bachelor of Science in Materials Science and Engineering (MSEN), authorize the submission of this degree program to the Texas Higher Education Coordinating Board (THECB) for approval and certify that all applicable THECB criteria have been met.

Background Information:

Industry demand and student interest in Materials Science and Engineering (MSEN) undergraduate program across Texas and the nation are growing. The U.S. Bureau of Labor Statistics’ (BLS) 2012 to 2022 Employment Projections Report indicates a 16.4 percent growth for material scientists and engineers in the State of Texas. Again, according to the BLS report, about 10% of the projected new jobs in materials science and engineering will be located in Texas; however, the current undergraduate programs in Texas only educate 2% of the national B.S. graduates in materials science and engineering. Therefore, the Department of Materials Science and Engineering at Texas A&M University (TAMU) is proposing a Bachelor of Science (B.S.) degree program in MSEN to launch in Fall 2017. TAMU is well positioned for this undertaking in that it will impart a significant benefit to the students and faculty of the University as well as the citizens of the state of Texas at large.

The establishment of this degree program is warranted by several factors:

- being responsive to and serving the existing and future economic needs in Texas and across the nation;
- offering a well-rounded education to Texas science and engineering students;
- responding to the encouraging survey results showing industry employer’s future need for B.S. degrees in MSEN;
- contributing to the improvement of the national rankings in the TAMU College of Engineering and Science and thus, attracting better students;
- providing well prepared undergraduate students who can pursue graduate degrees in materials science and engineering and related fields to address the increasing demand for MSEN advanced degrees in the nation.

The present situation in Texas regarding the production of B.S. graduates to meet industry needs is serious because there are only three (3) undergraduate MSEN programs in the state and no Texas flagship institution offers a Bachelor of Science in materials science and engineering.

There is also an increasing demand for B.S. materials science and engineering graduates to obtain advanced degrees. The current graduation rate from institutions across the country does not produce enough B.S. graduates to provide a sufficient domestic student pool to recruit both new hires for industry and students for graduate programs in Texas.
Therefore, at the current graduation rate for the Bachelors of Science in Materials Science and Engineering, Texas will fail to provide enough professionals to meet the industrial, research and scientific needs of our state and nation. As the pre-eminent engineering land-grant institution in Texas, it is our responsibility to anticipate these needs and to prepare future scientists, professionals and engineers who are competitive and flexible enough to keep pace with the increasing rate of technological advancement in our state, nation and worldwide.

A&M System Funding or Other Financial Implications:

The five-year costs associated with the MSEN undergraduate program start-up are estimated to be $2,982,868. This estimate includes $2,003,200 for new personnel including an undergraduate program coordinator, three additional faculty members and two professors of practice or senior lecturers, graduate assistants, and clerical staff. Facilities and equipment to support existing and the new laboratories should be around $927,668, and supplies and materials are estimated to be $26,500. Other costs, which include accreditation and travel costs, are estimated to be $25,500.

Approximately fifty percent (50%) of the new B.S. MSEN curriculum will leverage current MSEN courses and Dwight Look College of Engineering laboratories for materials are already in place. Most of the costs associated with the five-year startup plan for the MSEN program will be for the development and delivery of new (or highly modified) courses to support the new curriculum, including faculty salary, staff salary for student recruiting and enrollment advising, improved facilities and additional equipment.

Faculty required to deliver the B.S. MSEN curriculum will grow from today’s 14 Full-Time-Equivalent (FTE) in the existing MSEN department to 19 FTE (which includes three new full time tenure track faculty and two new non-tenure track professor of practice / lecturer) faculty over the five-year startup period to support program advising and new course development and delivery. Graduate Assistant Teaching (GAT) support will grow to ten (10) in the first five years to accommodate additional lab sections of current and new lab courses.

The five-year funding plan includes use of reallocated funds derived from the hiring of new faculty members who will focus on MSEN undergraduate courses. In addition to the estimated $945,000 of anticipated reallocated funds for faculty hiring, $2,037,868 will come from additional Differential Tuition (DT) funding that will be generated and used for non-tenure track professor of practice / lecturer salaries, full time program coordinator staff salary, GAT support, establishment of an undergraduate laboratory, procurement of new laboratory equipment, and lab supplies.
Members, Board of Regents  
The Texas A&M University System

Subject: Approval of a New Bachelor of Science Degree Program with a Major in Field of Study in Materials Science and Engineering and Authorization to Request Approval from the Texas Higher Education Coordinating Board

I recommend adoption of the following minute order:

“The Board of Regents of The Texas A&M University System approves the establishment of a new degree program at Texas A&M University- College Station, leading to a Bachelor of Science Degree Program with a Major in Field of Study in Materials Science and Engineering.

The Board also authorizes submission of Texas A&M University’s new degree program request to the Texas Higher Education Coordinating Board for approval and hereby certifies that all applicable criteria of the Coordinating Board have been met.”

Respectfully submitted,

Michael K. Young  
President

Approval Recommended:  

John Sharp  
Chancellor

Approved for Legal Sufficiency:

Ray Donilla  
General Counsel

Billy Hamilton  
Executive Vice Chancellor and  
Chief Financial Officer

James R. Hallmark, Ph.D.  
Vice Chancellor for Academic Affairs
TEXAS A&M UNIVERSITY
Bachelor of Science
With a major in Materials Science and Engineering
(CIPs: 14.1801.00)

PROGRAM REVIEW OUTLINE

BACKGROUND & PROGRAM DESCRIPTION

ADMINISTRATIVE UNIT: Dwight Look College of Engineering, Department of Materials Science and Engineering.

The Department of Materials Science and Engineering at Texas A&M University (TAMU) is proposing a Bachelor of Science (B.S.) degree program in Materials Science and Engineering (MSEN) for Fall 2017.

RATIONALE:

The establishment of this degree program is warranted by several factors:

- being responsive to and serving the existing and future economic needs in Texas and across the nation;
- offering a well-rounded education to Texas science and engineering students;
- responding to the encouraging survey results showing industry employer’s future need for B.S. degrees in MSEN;
- providing well prepared undergraduate students who can pursue graduate degrees in MSEN that address the increasing demand for MSEN advanced degrees in the nation.

According to the Texas Workforce Commission (TWC) projections, industry jobs in Texas for B.S. graduates in materials science and engineering are projected to increase 16.4% between 2012 and 2022, which is considerably higher than the national average for all industry clusters. According to the Occupational Outlook Handbook by the Bureau of Labor Statistics (BLS), about 10% of the projected new jobs in materials science and engineering in the nation will be located in Texas in the next decade, however, the current undergraduate programs in Texas only educate 2% of the national B.S. graduates in materials science and engineering.

The present situation in Texas is serious because there are only three (3) undergraduate MSEN programs in the state and no Texas flagship institution offers a Bachelor of Science in materials science and engineering. On the other hand, California has seven (7) undergraduate programs in materials science and engineering, Ohio has six (6), and Pennsylvania has six (6) undergraduate programs. The enrollment and the number of B.S. graduates from those programs have increased 5% annually over the last five years while the existing number of graduates from Texas remained nearly constant over that period.
There is also a demand for more B.S. materials science and engineering graduates to obtain advanced degrees. The current graduation rate from institutions across the country does not produce enough B.S. graduates to provide a sufficient domestic student pool to recruit both new hires for industry and students for graduate programs in Texas.

Therefore, at the current graduation rate for the Bachelors of Science in Materials Science and Engineering, Texas will fail to provide enough professionals to meet the industrial, research and scientific needs of our state and nation. As the pre- eminent engineering land-grant institution in Texas, it is our responsibility to anticipate these needs and to prepare future scientists, professionals and engineers who are competitive and flexible enough to keep pace with the increasing rate of technological advancement in our state, nation and worldwide.

CONTINGENCIES:

Texas A&M University, Dwight Look College of Engineering and the Department of Materials Science and Engineering is committed to seek accreditation for the Bachelor of Science degree program from the Accreditation Board for Engineering and Technology (ABET) upon graduation of its first class of students.

PROPOSED PROGRAM:

The Bachelor of Science (B.S.) degree awarded from the Department of Materials Science and Engineering (MSEN) at Texas A&M University will require 128 semester credit hours (SCHs). This curriculum builds on the common first-year sequence in engineering (27 SCHs), and the University Core Curriculum electives (24 SCHs) required of all TAMU undergraduates. The MSEN undergraduate major includes core MSEN undergraduate courses (59 SCHs) that provide a strong, common, foundation in materials science and engineering, MSEN electives (9 SCHs) that provide depth in a focus topic, and specialty technical electives (9 SCHs) to add breadth in interdisciplinary technical fields.

<table>
<thead>
<tr>
<th>Category</th>
<th>Semester Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education Core Curriculum (bachelor's degree only)</td>
<td>51</td>
</tr>
<tr>
<td>MSEN Core Courses</td>
<td>59</td>
</tr>
<tr>
<td>MSEN Technical Electives</td>
<td>9</td>
</tr>
<tr>
<td>Specialty Technical Electives</td>
<td>9</td>
</tr>
<tr>
<td>Other (Specify, e.g., internships, clinical work)</td>
<td>(if not included above)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>128</strong></td>
</tr>
</tbody>
</table>
Bachelor of Science in Materials Science and Engineering

- **Flexibility** to engage in one or more of several defined emphasis areas, or with guidance from a faculty mentor, create a custom emphasis degree plan.
- **Opportunities** to participate in internships with industry partners, and research in academic and government laboratories.
- **Integration** of laboratory experience with computational simulation.
- **Preparation** for employment as a professional engineer across a range of industries, including energy, biomedical, semiconductor, and defense.

Educational Objectives

MSEN graduates will be prepared to pursue careers as materials scientists and engineers, pursue advanced graduate study, or to apply their knowledge in other fields such as law, medicine or business. Graduates from our department will have the following skills:

- Apply fundamental materials processing, structure, properties, and performance relationships to identify and solve materials-related challenges,
- Master a broad suite of synthesis, characterization, and simulation techniques,
- Thrive in multidisciplinary engineering environments,
- Bridge the gap between fundamental research (science) and technology (engineering),
- Communicate effectively, both orally and in writing,
- Advance as future leaders in specific materials emphasis areas,
- Demonstrate an increased level of leadership and responsibility,
- Exhibit a commitment to professional ethics in their professional career.

Student Outcomes:

- An appropriate mastery of the knowledge, techniques, skills and modern tools of complex systems that span multiple engineering technology disciplines.
- An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology.
- An ability to conduct standard tests and measurements; to conduct, analyze and interpret experiments, and to apply experimental results to improve processes.
- An ability to apply creativity in the design of complex systems that span multiple engineering technology disciplines.
- An ability to function effectively on teams.
- An ability to identify, analyze and solve technical problems.
- An ability to apply written, oral, and graphical communication skills in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.
- An understanding of the need for and an ability to engage in self-directed continuing education and professional development.
- An ability to understand professional, ethical and social responsibilities.
- A respect for diversity and knowledge of contemporary professional, societal and global issues.
- A commitment to quality, timeliness, and continuous improvement.
EVIDENCE OF WORKFORCE NEED, STUDENT DEMAND, LACK OF DUPLICATION:

Workforce Need

Nationally, ten percent (10%) of all new materials science and engineering jobs will be located in Texas over the next decade. However, universities in Texas only produce two percent (2%) of the national B.S. degrees awarded in materials science and engineering.

More importantly, according to BLS, job prospects for materials scientists and engineers are favorable as they will be needed to fill positions as more experienced materials scientists and engineers are promoted or retire. Every year between 2012 and 2022, three percent (3%) of all-existing positions will be replaced with new B.S. graduates in materials science and engineering, indicating that thirty percent (30%) of the entire workforce will need to be replaced in the next 10 years.

State and National Trends in Employment for Materials Science and Engineering between 2012 and 2022

<table>
<thead>
<tr>
<th>United States</th>
<th>Employment 2012</th>
<th>Percent Change</th>
<th>Average Annual Jobs Due to Growth*</th>
<th>Average Annual Jobs Due to Replacements*</th>
<th>Projected Annual Job Openings</th>
<th>Total Job Openings Over the Next Decade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials Science and Engineers*</td>
<td>31,500</td>
<td>2.20%</td>
<td>70</td>
<td>940</td>
<td>1,010</td>
<td>10,100</td>
</tr>
<tr>
<td>Texas</td>
<td>Employment 2012</td>
<td>Percent Change</td>
<td>Average Annual Jobs Due to Growth</td>
<td>Average Annual Jobs Due to Replacements</td>
<td>Projected Annual Job Openings</td>
<td>Total Job Openings Over the Next Decade</td>
</tr>
<tr>
<td></td>
<td>2,320</td>
<td>16.40%</td>
<td>40</td>
<td>70</td>
<td>110</td>
<td>1,100</td>
</tr>
</tbody>
</table>

*Projected Annual Job Openings refers to the average annual job openings due to growth and net replacement.

Student Demand

The MSEN Department initiated a survey of undergraduate students enrolled in a series of selected lower level science and engineering classes to gauge interest in a B.S. degree in materials science and engineering. Almost twenty-nine percent (29%) of more than 1,000 undergraduate students surveyed reported they would have considered a major in MSEN as one of their top 3 or first choice as a major. Over sixty percent (60%) of the students surveyed would have explored or considered a major in materials science and engineering. Fifty percent (50%) of the students surveyed reported they were interested in materials science and engineering and almost twenty percent (20%) reported being very interested.

More strikingly, the State of Texas significantly lags behind other large economy states in producing adequate B.S. graduates in materials science and engineering. As mentioned above, Texas only has three

Program Outline: Page 4
(3) undergraduate programs while California has seven (7) undergraduate programs in materials science and engineering, Ohio has six (6), and Pennsylvania has six (6) programs. The enrollment and the number of B.S. graduates from those programs have increased 5% annually over the last five years while the existing number of graduates from Texas remained nearly constant over that period (24 degrees in 2010, 18 in 2011, 36 in 2012, 22 in 2013, and 33 in 2014, See Table 6). Therefore, there is a need for an undergraduate program in a flagship Texas school to produce enough B.S. graduates to serve the Texas economy and satisfy demand.

Lack of Duplication of Program

- Number of B.S. degree programs in the state with the same 6-digit CIP: 3
- Number of B.S. degree programs within a 60-minute drive with same 6-digit CIP: 0

ENROLLMENT PROJECTIONS:

We expect the process of establishing a full program with complete course offerings would occur over a five-year period. A comprehensive recruitment program in years 1 and 2 will focus on attracting domestic students from Texas, and in particular, among the underrepresented student groups and first-generation college students. As it matures, the MSEN undergraduate program will accept 100 undergraduate students per year. The table below illustrates the target number of 300 undergraduate students with an eighty-five percent (85%) retention rate and an average graduation time of less than 4.5 years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Change of Major/Transfers</th>
<th>New Students</th>
<th>Attrition</th>
<th>Graduation</th>
<th>Cumulative Headcount</th>
<th>Cumulative FTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>60</td>
<td>3</td>
<td>0</td>
<td>122</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>80</td>
<td>7</td>
<td>0</td>
<td>215</td>
<td>138</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>80</td>
<td>11</td>
<td>42</td>
<td>262</td>
<td>213</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>80</td>
<td>13</td>
<td>64</td>
<td>285</td>
<td>231</td>
</tr>
</tbody>
</table>

COSTS:

Approximately fifty percent (50%) of the new MSEN curriculum will leverage current MSEN courses and Look College laboratories already in place. Most of the costs associated with the five-year startup plan for the MSEN program will be for the development and delivery of new (or highly modified) courses to support the new curriculum, including faculty salary, staff salary for student recruiting and enrollment advising, improved facilities and additional equipment.

The Faculty required to deliver the MSEN curriculum will grow from today’s 14 Full-Time-Equivalent (FTE) to 19 FTE (which includes three new full time tenure track faculty and two new non-tenure track professor of practice / lecturer) faculty over the five-year startup period to support program advising and new course development and delivery. From year three (3) to five (5), the need for lecturers will grow from one (1) to three (3) FTEs to support growth requirements for new sections of current and new
MSEN courses. Graduate Assistant Teaching (GAT) support will grow to ten (10) in the first five years to accommodate additional lab sections of current and new lab courses. Administrative costs will include a full-time program coordinator beginning in year one (1). The five-year funding plan includes use of reallocated funds derived from the hiring of new faculty members who will focus on MSEN undergraduate courses. In addition to the estimated $945,000 of anticipated reallocated funds for faculty hiring, $2,037,868 will come from additional Differential Tuition (DT) funding that will be generated and used for non-tenure track professor of practice / lecturer salaries, full time program coordinator staff salary, GAT support, establishment of an undergraduate laboratory, procurement of new laboratory equipment, and lab supplies.

### Five-Year Costs and Funding Sources

<table>
<thead>
<tr>
<th>Five-Year Costs</th>
<th>Five-Year Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel¹</td>
<td>$2,003,200</td>
</tr>
<tr>
<td>Facilities and Equipment</td>
<td>Reallocated Funds</td>
</tr>
<tr>
<td>Library, Supplies, and Materials</td>
<td>$927,668</td>
</tr>
<tr>
<td>Other²</td>
<td>Anticipated New Formula Funding³</td>
</tr>
<tr>
<td>Total Costs</td>
<td>Special Item Funding</td>
</tr>
<tr>
<td></td>
<td>Other⁴ (includes DT funds)</td>
</tr>
<tr>
<td></td>
<td>$2,982,868</td>
</tr>
</tbody>
</table>

The Chief Executive Officer of the institution has certified that the institution will have funds sufficient to support the proposed program.
New Bachelor's and Master's Degree
Cover Page/Signature Page

Directions: An institution shall use this form to propose a new bachelor's or master's degree program. In completing the form, the institution should refer to the document Standards for Bachelor's and Master's Programs, which prescribes specific requirements for new degree programs. Note: This form requires signatures of (1) the Chief Executive Officer, certifying adequacy of funding for the new program, (2) a member of the Board of Regents (or designee), certifying Board approval, and (3) if applicable, a member of the Board of Regents or (designee), certifying that criteria have been met for staff-level approval. NCTE: Preliminary authority is required for all engineering programs. An institution that does not have preliminary authority for a proposed engineering program shall submit a separate request for preliminary authority prior to submitting the degree program request form. That request shall address criteria set in Coordinating Board rules Section 5.24 (a).

Information: Contact the Division of Academic Affairs and Research at 512/427-6200 for more information.

### Administrative Information

1. **Institution:** Texas A&M University

2. **Program Name** – Show how the program would appear on the Coordinating Board's program inventory (e.g., Bachelor of Business Administration degree with a major in Accounting):

   **Bachelor of Science degree with a major in Materials Science and Engineering**

<table>
<thead>
<tr>
<th>CIP Code Description</th>
<th>CIP Code</th>
<th>Degree Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Assoc</td>
</tr>
<tr>
<td>ENGINEERING</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>MATERIALS SCIENCE AND ENGINEERING</td>
<td>14.1801.00</td>
<td>MS (32 SCH)</td>
</tr>
</tbody>
</table>

### THECB Proposed Program Inventory for Texas A&M University - 003632

<table>
<thead>
<tr>
<th>CIP Code Description</th>
<th>CIP Code</th>
<th>Degree Levels</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Assoc</td>
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<tr>
<td>ENGINEERING</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>MATERIALS SCIENCE AND ENGINEERING</td>
<td>14.1801.00</td>
<td>B.S. (128 SCH)</td>
</tr>
</tbody>
</table>

3. **Proposed THECB CIP Code:** 14.1801 Title: Materials Science and Engineering.

4. **Number of Required Semester Credit Hours (SCHs)** (If the number of SCHs exceeds 120 for a Bachelor's program, the institution must request a waiver documenting the compelling academic reason for requiring more SCHs): **128**
The Bachelor of Science (B.S.) degree awarded from the Department of Materials Science and Engineering (MSEN) at Texas A&M University requires 128 semester credit hours (SCHs). This curriculum builds on the common first-year sequence in engineering (27 SCHs), and the University Core Curriculum electives (24 SCHs) required of all TAMU undergraduates. The MSEN undergraduate major includes core MSEN undergraduate courses (59 SCHs) that provide a strong, common, foundation in materials science and engineering, MSEN electives (9 SCHs) that provide depth in a focus topic and specialty technical electives (9 SCHs) to add breadth in interdisciplinary technical fields.

We request a waiver to exceed the required 120 SCH maximum for a Bachelor’s program so that this program is on par with existing engineering programs in the Dwight Look College of Engineering. The 128 SCH requirement for our existing engineering programs will satisfy ABET requirements for depth and breadth in the engineering discipline, math and science, and satisfy the core curriculum requirements. The 128 SCH requirement has helped position seven current BS degree programs offered by the Dwight Look College of Engineering to be ranked among the top 10 programs offered by public institutions in the nation. The proposed B.S. in MSEN will require similar depth and breadth to satisfy ABET accreditation and core curriculum requirements.

5. Brief Program Description – Describe the program and the educational objectives:

Materials science and engineering is an interdisciplinary field that centers on understanding the physical properties of matter, and producing materials with specific characteristics to serve a desired function.

Materials scientists study the connections between material synthesis/processing, matter’s underlying structure, and the properties and performance provided by the structure.

Materials engineers develop materials and manufacturing techniques and integrate these materials into commercial products.

Practicing materials scientists and engineers utilize different processing, characterization, modeling, and simulation techniques to solve fundamental materials challenges and enable new materials, devices, and technologies.

Materials Science and Engineering is inherently interdisciplinary; therefore, this degree was designed jointly by faculty in the College of Engineering and the College of Science. The proposed program also complements the existing M.S., M.Eng. and Ph.D. degrees in Materials Science and Engineering at Texas A&M University.

Materials scientists and engineers play crucial roles in nearly all industry sectors, including energy, defense and homeland security, biomedicine, electronics, transportation, infrastructure, and personal care products. The proposed B.S. degree will allow students to obtain a customized learning experience including computational materials science, polymers and soft materials, corrosion engineering, materials design/processing/characterization/simulation, and advanced structural materials. Students may have opportunities to participate in study abroad programs, industrial internships, and undergraduate research or entrepreneurship opportunities.
MSEN B.S. graduates will be prepared to pursue careers as materials engineers and scientists, pursue advanced graduate study, or to apply their knowledge in other areas such as law, medicine or business. Graduates from our department will have the following skills:

- Bridge the gap between fundamental research (science) and technology (engineering),
- Apply fundamental materials processing, structure, properties, and performance relationships to identify and solve materials-related challenges,
- Master a broad suite of synthesis, characterization, and simulation techniques,
- Thrive in multidisciplinary engineering environments,
- Advance as future leaders in specific materials science and engineering areas.

The MSEN B.S. degree program will seek accreditation from ABET at the appropriate time. Guidance and academic advising will be provided through the Department of Materials Science and Engineering.

6. **Administrative Unit** – Identify where the program would fit within the organizational structure of the university (e.g., The Department of Electrical Engineering within the College of Engineering):

   The Department of Materials Science and Engineering within the Dwight Look College of Engineering

7. **Proposed Implementation Date** – Report the date that students would enter the program (MM/DD/YY): 08/21/2017

8. **Contact Person** – Provide contact information for the person who can answer specific questions about the program:

   Name: Dr. Ibrahim Karaman
   Title: Professor and Department Head
   E-mail: ikaraman@tamu.edu
   Phone: 979-862-3923
New Program Request Form for Bachelor's and Master's Degrees

Directions: An institution shall use this form to propose a new bachelor's or master's degree program that is in the field of engineering or has costs exceeding $2 million for the first five years of operation. In completing the form, the institution should refer to the document Standards for Bachelor's and Master's Programs, which prescribes specific requirements for new degree programs. Note: This form requires signatures of (1) the Chief Executive Officer or Chief Academic Officer, certifying adequacy of funding for the new program and the notification of other institutions; (2) a member of the Board of Regents (or designee), certifying Board approval. NOTE: Preliminary notification is required for all engineering programs. Prior to submission of an engineering program proposal, the institution should notify the Division of Workforce, Academic Affairs and Research of its intent to request such a program.

For more information: Contact the Division of Workforce, Academic Affairs and Research at 512/427-6200.

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Administrative Information

1. **Institution:** Texas A&M University

2. **Program Name** – Show how the program would appear on the Coordinating Board’s program inventory (e.g., Bachelor of Business Administration degree with a major in Accounting):

**Bachelor of Science degree with a major in Materials Science and Engineering**

**THECB Current Program Inventory for Texas A&M University - 003632**

<table>
<thead>
<tr>
<th>CIP Code Description</th>
<th>CIP Code</th>
<th>Degree Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Assoc Baccalaureate Master's Doctoral Professional</td>
</tr>
<tr>
<td><strong>ENGINEERING</strong></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>MATERIALS SCIENCE AND ENGINEERING</td>
<td>14.1801.00</td>
<td>MS (32 SCH) PHD (96 SCH)</td>
</tr>
</tbody>
</table>

**THECB Proposed Program Inventory for Texas A&M University – 003632**

<table>
<thead>
<tr>
<th>CIP Code Description</th>
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<td>14</td>
<td></td>
</tr>
<tr>
<td>MATERIALS SCIENCE AND ENGINEERING</td>
<td>14.1801.00</td>
<td>B.S. (128 SCH) MS (32 SCH) PHD (96 SCH) Start Date: Fall 2017</td>
</tr>
</tbody>
</table>

3. **Proposed THECB CIP Code:** 14.1801 Title: Materials Science and Engineering.

4. **Number of Required Semester Credit Hours (SCHs)** (If the number of SCHs exceeds 120 for a Bachelor’s program, the institution must request a waiver documenting the compelling academic reason for requiring more SCHs): 128

The Bachelor of Science (B.S.) degree awarded from the Department of Materials Science and Engineering (MSEN) at Texas A&M University requires 128 semester credit hours (SCHs). This curriculum builds on the common first-year sequence in engineering (27 SCHs), and the University Core Curriculum electives (24 SCHs) required of all TAMU undergraduates. The MSEN undergraduate major includes core MSEN undergraduate courses (59 SCHs) that provide a strong, common, foundation in materials science and engineering, MSEN electives (9 SCHs) that provide depth in a focus topic, and specialty technical electives (9 SCHs) to add breadth in interdisciplinary technical fields.

We request a waiver to exceed the required 120 SCH maximum for a Bachelor’s program so that this program is on par with existing engineering programs in the Dwight Look College of Engineering. The 128 SCH requirement for our existing engineering programs will satisfy ABET requirements for depth and breadth in the engineering discipline, math and science, and satisfy the core curriculum.

Request for New B.S. Degree Program
Page 2
requirements. The 128 sch requirement has helped position seven current BS
degree programs offered by the Dwight Look College of Engineering to be ranked
among the top 10 programs offered by public institutions in the nation. The
proposed B.S. in MSEN will require similar depth and breadth to satisfy ABET
accreditation and core curriculum requirements.

5. Brief Program Description – Describe the program and the educational objectives:

Materials science and engineering is an interdisciplinary field that centers on understanding the
physical properties of matter, and producing materials with specific characteristics to serve a
desired function.

Materials scientists study the connections between materials synthesis/processing, matter's
underlying structure, and the properties and performance given the structure.

Materials engineers develop materials and manufacturing techniques and integrate these
materials into commercial products.

Practicing materials scientists and engineers utilize different processing, characterization,
modeling, and simulation techniques to solve fundamental materials challenges and enable new
materials, process, devices, and technologies.

Materials Science and Engineering is inherently interdisciplinary. Therefore, this degree was
designed jointly by faculty in the College of Engineering and the College of Science. The proposed
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learning experience including computational materials science, polymers and soft materials,
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8. **Contact Person** – Provide contact information for the person who can answer specific questions about the program:

   **Name:** Dr. Ibrahim Karaman  
   **Title:** Professor and Department Head  
   **E-mail:** ikaraman@tamu.edu  
   **Phone:** 979-862-3923
PROGRAM INFORMATION

Executive Summary

The Department of Materials Science and Engineering at Texas A&M University (TAMU) is proposing a Bachelor of Science (B.S.) degree program in Materials Science and Engineering (MSEN) beginning Fall 2017.

The establishment of this degree program is warranted by several factors:

- being responsive to and serving the existing and future economic needs in Texas and across the nation;
- offering a well-rounded education to Texas science and engineering students;
- responding to the encouraging survey results showing industry employer's future need for B.S. degrees in MSEN;
- providing well prepared undergraduate students who can pursue graduate degrees in MSEN that address the increasing demand for MSEN advanced degrees in the nation.

The present situation in Texas is serious because there are only three (3) undergraduate MSEN programs in the state and no Texas flagship institution offers a Bachelor of Science in materials science and engineering.

Industry jobs in Texas for B.S. graduates in materials science and engineering are projected to increase 16.4% between 2012 and 2022, which is considerably higher than the national average for all industry clusters.

\[
\text{Nationally, ten percent (10\%) of all new materials science and engineering jobs will be located in Texas over the next decade. However, universities in Texas only produce two percent (2\%) of the national B.S. degrees awarded in materials science and engineering.}
\]

There is also a demand for more B.S. materials science and engineering graduates to obtain advanced degrees. The current graduation rate from institutions across the country does not produce enough B.S. graduates to provide a sufficient domestic student pool to recruit both new hires for industry and students for graduate programs in Texas.

\[
\text{Therefore, at the current graduation rate for the Bachelors of Science in Materials Science and Engineering, Texas will fail to provide enough professionals to meet the industry, research and scientific needs of our state and nation.}
\]

\[
\text{As the pre-eminent engineering land-grant institution in Texas, it is our responsibility to anticipate these needs and to prepare future scientists, professionals and engineers who are competitive and flexible enough to keep pace with the increasing rate of technological advancement in our state, nation and worldwide.}
\]
I. **Need**

A. **Job Market Need** - Provide short- and long-term evidence of the need for graduates in the job market.

---

**Employment Trends**

Texas is home to the second-largest concentration of materials-processing plants in the world in the Houston and Corpus Christi areas. Within the state is one of the nation's largest complexes of oil/gas and oil/gas services industrial firms. The Dallas and Austin metropolitan areas have photovoltaic cell and other semiconductor fabrication, research, and development operations (Freescale, AMD, TI, National Instruments, Samsung, and Sematech), with smaller, energy-materials concerns in almost every large and intermediate sized metropolitan area. Houston is a hub for the medical industry and, more recently, for alternative energy firms. Moreover, the state already houses many aerospace companies and currently is attempting to attract new technology companies aligned with recent national initiatives that promote new commercial space companies. Polymer/plastics production and processing in the state rivals the rest of the U.S. combined (Dow, Huntsman, Exxon-Mobil, BASF, BP, 3M, Chevron, Shell, SABIC, LyondellBasell, and others have a large presence). According to the Overview of the Texas Economy, Texas added more jobs than any other state in 2014 and led the nation in job growth for the fifth consecutive year.

These and many other important industries rely directly or indirectly on developing new materials that enable future technological breakthroughs: advanced coating technologies to ameliorate corrosion in the oil and gas industry, advanced high temperature structural materials for propulsion and thermal shielding in aerospace vehicles, advanced semiconductor materials to enhance electronic device efficiency, new polymeric materials with multi-functional capabilities. As current technologies reach their operating limits, the need to discover, develop and deploy new materials capable of enabling the next generation technologies will only increase.

---

**Evidence of a dynamic market -- the future industry projections for Texas show a broad range of occupations for B.S. graduates in materials science and engineering. This is compelling evidence to create a new degree program.**

It is thus not surprising that current trends suggest a healthy growth in the demand for materials scientists and engineers in the near and the medium term. According to the Bureau of Labor Statistics (BLS) Job Outlook for 2012 to 2022 the national discipline of engineering will see a nine percent (9%) increase in employment over the next decade. Because the workforce is aging, over sixty-seven percent (67%) of the additional job openings from 2012-2022 will come from replacement positions for those who retire or leave the workforce.

According to the Occupational Outlook Handbook by BLS, the number of new jobs will increase 2.2 percent across the nation for B.S. graduates in materials science and engineering graduates between 2012 and 2022. More importantly, according to BLS, job prospects for materials scientists and engineers is favorable as they will be needed to fill positions as more experienced materials scientists and engineers are promoted or retire. Every year between 2012 and 2022, three percent (3%) of all-existing positions will be replaced with new B.S. graduates in materials science and engineering, indicating that thirty percent 30% of the entire workforce will need to be replaced in the next 10 years. Prospects should also be positive for those trained in specialized fields of materials engineering such as ceramics, corrosion, electronic materials, failure analysis, polymers, and biomaterials.

According to the Texas Workforce Commission (TWC) projections shown in Table 1, there will be a 16.4 % increase in overall job openings for B.S. graduates in materials science and engineering between...
2012-2022. There will be approximately 110 annual job openings in Texas alone each year requiring a B.S. in materials science and engineering, seventy percent (70%) of the new jobs each year will be replacements for retirements within the workforce, and approximately forty (40) jobs will be available annually due to growth\(^4\). However, the undergraduate programs in Texas (University of Texas at El Paso, University of North Texas, and Rice University) have only granted an average of 27 B.S. degrees per year during the last five (5) years without a notable increase in the number of B.S. graduates\(^5\).\(^6\).\(^7\). Clearly, there is an urgent demand to increase the numbers of B.S. graduates in materials science and engineering in Texas\(^5\).\(^6\).\(^7\).

**Table 1. State and National Trends in Employment for Materials Science and Engineering between 2012 and 2022**

<table>
<thead>
<tr>
<th>United States</th>
<th>Employment 2012</th>
<th>Percent Change</th>
<th>Average Annual Jobs Due to Growth*</th>
<th>Average Annual Jobs Due to Replacements*</th>
<th>Projected Annual Job Openings</th>
<th>Total Job Openings Over the Next Decade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials Science and Engineers*</td>
<td>31,500</td>
<td>2.20%</td>
<td>70</td>
<td>940</td>
<td>1,010</td>
<td>10,100</td>
</tr>
<tr>
<td>Texas</td>
<td>Employment 2012</td>
<td>Percent Change</td>
<td>Average Annual Jobs Due to Growth</td>
<td>Average Annual Jobs Due to Replacements</td>
<td>Projected Annual Job Openings</td>
<td>Total Job Openings Over the Next Decade</td>
</tr>
<tr>
<td>Materials Science and Engineers***</td>
<td>2,320</td>
<td>16.40%</td>
<td>40</td>
<td>70</td>
<td>110</td>
<td>1,100</td>
</tr>
</tbody>
</table>

\(^1\)Projected Annual Job Openings refers to the average annual job openings due to growth and net replacement.
\(^3\)http://www.bls.gov/oco/ocos092.htm
\(^5\)Texas Workforce Commission, Labor Market & Career Information Department

The BLS data in Figure 1 and Table 2 show Texas has the second highest employment level in both materials science and materials engineering occupations in the nation. Considering the fact that there will be a substantial job growth in Texas in the next decade and about 30% of the existing positions need to be replaced due to retirement or promotion, there will be many job openings with high annual pay (Table 2) for graduates from materials science and engineering\(^5\). However, B.S. degrees awarded in materials science and engineering shows Texas is not among the top 10 states\(^5\). Examining the employment levels in Texas and in the nation for materials scientists and engineers (with a B.S.), it is clear that our higher education system in Texas is not providing enough qualified professionals in materials science and engineering to meet our state or national employment needs.

**Evidence of a dynamic market -- the future industry projections for Texas show a broad range of occupations for B.S. graduates in materials science and engineering. This is compelling evidence to create a new degree program.**
Figure 1. Employment of Materials Scientists and Engineers by State, May, 2014
EMPLOYMENT: Population of professionals employed in materials science and engineering.
http://www.bls.gov/oes/current/oes172131.htm

Table 2. States with the Highest Employment Level in Materials Science and Engineering
Showing Texas has the Second Highest Employment Level in Both Categories.

<table>
<thead>
<tr>
<th>State</th>
<th>Employment for Materials Engineers</th>
<th>Employment per thousand jobs</th>
<th>Hourly mean wage</th>
<th>Annual mean wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>2,310</td>
<td>0.15</td>
<td>$52.40</td>
<td>$108,980</td>
</tr>
<tr>
<td>Texas</td>
<td>2,000</td>
<td>0.18</td>
<td>$44.79</td>
<td>$93,170</td>
</tr>
<tr>
<td>New York</td>
<td>1,560</td>
<td>0.18</td>
<td>$42.61</td>
<td>$88,620</td>
</tr>
<tr>
<td>Ohio</td>
<td>1,490</td>
<td>0.29</td>
<td>$43.83</td>
<td>$91,160</td>
</tr>
<tr>
<td>Michigan</td>
<td>1,460</td>
<td>0.36</td>
<td>$37.68</td>
<td>$78,380</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>State</th>
<th>Employment for Materials Scientists</th>
<th>Employment per thousand jobs</th>
<th>Hourly mean wage</th>
<th>Annual mean wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>1,120</td>
<td>0.07</td>
<td>$48.52</td>
<td>$100,930</td>
</tr>
<tr>
<td>Texas</td>
<td>540</td>
<td>0.05</td>
<td>$51.73</td>
<td>$107,610</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>520</td>
<td>0.16</td>
<td>$40.76</td>
<td>$84,780</td>
</tr>
<tr>
<td>Ohio</td>
<td>500</td>
<td>0.10</td>
<td>$48.81</td>
<td>$101,530</td>
</tr>
<tr>
<td>New York</td>
<td>460</td>
<td>0.05</td>
<td>$47.10</td>
<td>$97,960</td>
</tr>
</tbody>
</table>

EMPLOYMENT: Population of professionals employed in materials science and engineering.
One clear implication from studies of energy efficient technologies and practices is a growing need for individuals with knowledge and skills related to basic materials design for energy efficiency, energy creation, and manufacturing\textsuperscript{14}. Evidence suggests that there will be a skill shortage among the current workforce to meet the demand to conserve existing resources and enhance sustainability. From the report \textit{Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations}\textsuperscript{8}, materials science and engineering is an employment cluster with potential to have substantial impact on the primary building blocks needed for greening our overall national occupations. The “greening” of occupations refers to the extent to which green economy activities and technologies increase the demand for existing occupations, shape the work and worker requirements needed for occupational performance, or generate unique work and worker requirements.

Figure 2 shows the long-term projections for selected industries where materials science and engineering graduates would likely obtain employment\textsuperscript{10,11}. The growth rates in the manufacturing industries show a strong demand over the decade and a need for graduates with expertise in fundamental materials science and engineering to fill the openings and growth in these areas\textsuperscript{14}. The “Materials” cluster once used broadly in occupational descriptions will break down into subcategories to more accurately reflect the necessary knowledge in materials design, development, use, and degradation/failure analysis\textsuperscript{14}.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{chart.png}
\caption{Long-Term Industry Projections in Texas related to Materials Science and Engineering, by Selected Industry and Growth Rate, 2012-2022}
\label{fig:materials}
\end{figure}

\textbf{Figure 2.} Long-Term Industry Projections in Texas related to Materials Science and Engineering, by Selected Industry and Growth Rate, 2012-2022  
\textbf{SOURCE:} The Labor Market & Career Information Department (LMCI) of the Texas Workforce Commission  
\textbf{TRACER:} Texas Labor Market Information.  
The Student Engineers' Council (SEC) at Texas A&M University hosts a career fair each fall for national and international companies to visit the campus to recruit potential employees and interns. The 2015 Fall Career Fair had over 415 companies in attendance. Twenty percent (20%) of those companies (83) self-identified as specifically recruiting materials science and engineering majors, even though Texas A&M does not currently have an undergraduate program. **Companies want and need new materials science and engineering graduates to meet their current and future staffing needs.**

Planning necessitates providing a workforce educated in the design, development, fabrication and selection of materials to serve these industries that will be responsible for a large share of the future growth of the Texas economy and that of the nation.
"Graduate Programs" as an Employer

Industry is not the only competitor in the market for new B.S. graduates in materials science and engineering. For many industry positions, there is a need to prepare high-quality B.S. graduates who will undertake additional training before pursuing research-focused careers. Graduate programs — especially those in the “Top 20” Universities, heavily recruit from state universities such as Texas A&M. It is estimated that thirty percent (30%) of our MSEN B.S. graduates will choose to pursue graduate school.

Figure 3 presents the longitudinal average annual demand for professionals when the BLS and TWC data\(^3\), \(^4\), \(^5\), \(^10\) on potential graduate student opportunities are combined for the state of Texas. When the supply of B.S. graduates produced in Texas is plotted, it is obvious that Texas is not producing enough graduates to meet the industry and research needs of the state.

![Figure 3: Average Annual Demand Forecast for Professionals with Materials Science and Engineering Expertise in Texas, 2012-2022](image)

**Figure 3.** Average Annual Demand Forecast for Professionals with Materials Science and Engineering Expertise in Texas, 2012-2022

*B.S. Degrees Awarded Source: American Society for Engineering Education (ASEE), 2015*

*National Data Source: Bureau of Labor Statistics, Office of Occupational Statistics and Employment Projections*

*State Data Source: Texas Workforce Commission, Labor Market & Career Information Department*

**METHODOLOGY:** National Demand for Graduate Students: The total domestic M.S. and Ph.D. graduates were used as the baseline demand for domestic graduate students and a +5% percent change was applied annually to estimate future demand. National Average Annual Industry Demand forecasted for the State Texas in Materials Science and Engineering was provided by BLS and TWC.
While Figure 3 illustrates the state demand\textsuperscript{10}, Figure 4 presents the national annual demand forecast for professionals with materials science and engineering expertise over the next decade\textsuperscript{5, 6, 7, 10}. The national supply of B.S. graduates does not meet the combined need to supply our research institutions with qualified graduate students or industry with qualified employees.

![Graph showing annual demand forecast for professionals with materials science and engineering expertise from 2014 to 2022.]

**Figure 4.** Average Annual Demand Forecast for Professionals with Materials Science and Engineering Expertise Nationally, 2012-2022

*B.S. Degrees Awarded Source: American Society for Engineering Education (ASEE), 2015*


*METHODOLOGY: National Demand for Graduate Students: The total domestic M.S. and Ph.D. graduates were used as the baseline demand for domestic graduate students and a +5% percent change was applied annually to estimate future demand. National Average Annual Industry Demand forecasted for the State Texas in Materials Science and Engineering was provided by BLS and TWC.*
Building Domestic Capacity

In the spring of 2007, an Issues in Science and Technology article\(^9\) discussed the increasing demand for engineering graduates and the shortage experienced in hiring Ph.D. graduates for faculty positions. The issue of having to compete with industry for qualified B.S. graduates influences our nation and our state as we compete not only among other institutions of higher education for graduate students but industry positions both domestic and abroad. The need to produce enough domestic students completing B.S. degrees in materials science and engineering is required for us to compete for potential masters and doctoral graduate students through the B.S. graduate supply.

In 2014, approximately 6,000 students were enrolled in graduate (M.S. + Ph.D.) programs in materials science and engineering across the country\(^5\)\(^7\). Of these, forty-six percent (46\%) of the students were domestic and fifty-four percent (54\%) foreign nationals.

Figure 5 illustrates that in 2014, there were 1,894 graduate (M.S. + Ph.D.) degrees awarded in materials science and engineering with forty-nine percent (49\%) domestic students and fifty-one percent (51\%) foreign nationals\(^5\)\(^7\). In other words, nationally, nine-hundred thirty-four (934) graduate degrees were awarded to U.S. Citizens. Considering the number of degrees awarded and industry needs in Figures 3 and 4, the pool from which U.S. schools may recruit domestic B.S. graduates for graduate programs is quite small for materials science and engineering.

![Figure 5. Historic Graduate Degrees Awarded in Materials Science and Engineering by Citizenship Status, ASEE](Image)

Primary Source: ASEE Engineering Data Management System, 2015
In Texas for 2014, four of the eight graduate degree-granting institutions had more than 50% of their master's and doctoral degrees awarded to foreign nationals. Overall, out of one-hundred eight (108) graduate (M.S. + Ph.D.) degrees awarded in Texas, sixty-six (66) were to international students. At Texas A&M University, only thirty percent (30%) of 135 graduate students in the MSEN department are domestic students; there is a striking lack of sufficient domestic applicants to choose from. Therefore, there is an urgent need to produce more B.S. degrees in Texas.

Industry Survey
The MSEN Department surveyed over 300 industry representatives by email in fall 2015. Over 120 senior members of industry responded to the survey, representing a broad range of U.S. States, Europe, and Asia (see Appendix B). The survey reported an industry need and employment market for graduates with a Bachelor of Science in materials science and engineering. Over ninety-eight percent (98%) of the respondents reported a new MSEN B.S. degree from Texas A&M would be beneficial to the state and as a national resource for materials science and engineering expertise. Over ninety-five percent (95%) reported they would hire a MSEN B.S. graduate from Texas A&M. Respondents reported ninety-four percent (94%) of the organizations had employees who currently have or need materials properties, characterization, processing or selection knowledge or expertise.

<table>
<thead>
<tr>
<th>Table 3. Most Commonly Recruited Science and Engineering Majors for Materials Science and Engineering Jobs, Fall 2015 Industry Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials Science and Engineering                           93</td>
</tr>
<tr>
<td>Mechanical Engineering                                      79</td>
</tr>
<tr>
<td>Metallurgy                                                   70</td>
</tr>
<tr>
<td>Chemical Engineering                                        58</td>
</tr>
<tr>
<td>Electrical Engineering                                      48</td>
</tr>
</tbody>
</table>

SOURCE: Fall 2015 Industry Survey, Department of Materials Science and Engineering, TAMU

<table>
<thead>
<tr>
<th>Table 4. Desired Knowledge Areas, Fall 2015 Industry Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials Failure                                           72</td>
</tr>
<tr>
<td>Materials Processing                                        66</td>
</tr>
<tr>
<td>Metallurgy                                                  65</td>
</tr>
<tr>
<td>Coatings                                                   62</td>
</tr>
<tr>
<td>Corrosion                                                   59</td>
</tr>
</tbody>
</table>

SOURCE: Fall 2015 Industry Survey, Department of Materials Science and Engineering, TAMU

Materials sciences and engineering was the most commonly recruited major for those hiring new materials science and engineering professionals. Table 3 shows Mechanical Engineering (second) and Metallurgy (third) as resource pools for materials science and engineering new hires.

The knowledge and skills most desired in new employees by industry centered on scientific knowledge areas in Materials Failure and Processing. Table 4 shows the five (5) knowledge areas most demanded in new hires from industry participants in the study.

This information strongly correlates with the core curriculum proposed by MSEN for its B.S. degree designed around strong courses in science and provides interest areas for specialty focus for students as they pursue and develop their degree program.

Responses for projected job openings show a strong and steady demand for new graduates, and provide a more positive picture of job openings than the national averages reported by BLS estimates. The entire survey is available in Appendix B.

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B. **Student Demand** – Provide short- and long-term evidence of demand for the program.

According to Texas Higher Education Coordinating Board (THECB), there will be an average of 6.9% increase in enrollment of all Texas public universities from 2015 to 2020\textsuperscript{10}. The Dwight Look College of Engineering at Texas A&M is in the process of expanding the engineering programs so that the enrollment will grow to 25,000 by 2025. The Look College currently admits all freshmen into the general engineering program. The students declare their major at the end of the first year. Based on the recent student survey of more than 1,000 undergraduate students on campus, among sophomores and potential freshmen, there will be significant number of students interested in materials science and engineering with existing recruitment efforts. The Texas A&M University Student Survey is attached as Appendix C.

**PEER Institution Comparisons**

The Dwight Look College of Engineering is one of the largest engineering schools in the country, ranking third in undergraduate enrollment and ninth in graduate enrollment by the American Society for Engineering Education (ASEE). Our college consistently ranks among the nation's top public undergraduate and graduate engineering programs, according to *U.S. News & World Report*.

Table 5 presents historic enrollment from 2010-2014 for B.S. materials science and engineering programs in the 2015 U.S. World News and Report's "Top Ten Engineering Schools"\textsuperscript{13}. Most institutions comparable to Texas A&M University have sizeable undergraduate programs in materials science and engineering. More importantly, the major public universities such as Georgia Tech, University of Illinois in Urbana-Champaign, University of Michigan, and UC-Berkeley have experienced significant growth in their engineering enrollment in the last 5 years. Building on the success of our graduate program, establishing an undergraduate program at this time is the next logical step in establishing a strong materials science and engineering department at Texas A&M.

<table>
<thead>
<tr>
<th>University</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massachusetts Institute of Technology</td>
<td>134</td>
<td>145</td>
<td>136</td>
<td>126</td>
<td>113</td>
</tr>
<tr>
<td>Stanford University</td>
<td>40</td>
<td>42</td>
<td>28</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td>University of California—Berkeley</td>
<td>85</td>
<td>82</td>
<td>77</td>
<td>99</td>
<td>103</td>
</tr>
<tr>
<td>California Institute of Technology</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>University of Illinois—Urbana-Champaign</td>
<td>309</td>
<td>379</td>
<td>385</td>
<td>410</td>
<td>409</td>
</tr>
<tr>
<td>Carnegie Mellon University</td>
<td>112</td>
<td>116</td>
<td>120</td>
<td>128</td>
<td>134</td>
</tr>
<tr>
<td>Georgia Institute of Technology</td>
<td>124</td>
<td>153</td>
<td>260</td>
<td>259</td>
<td>321</td>
</tr>
<tr>
<td>University of Michigan—Ann Arbor</td>
<td>122</td>
<td>119</td>
<td>137</td>
<td>147</td>
<td>161</td>
</tr>
<tr>
<td>Cornell</td>
<td>85</td>
<td>94</td>
<td>79</td>
<td>71</td>
<td>69</td>
</tr>
<tr>
<td>Purdue</td>
<td>140</td>
<td>115</td>
<td>128</td>
<td>137</td>
<td>153</td>
</tr>
</tbody>
</table>

* No freshman class  
** Data Unavailable

Source: ASEE Engineering Data Management System, 2015

According to the American Society for Engineering Education (ASEE), Figure 6 reports 1,440 Bachelor’s degrees awarded in 2013-2014 in materials science and engineering, ranking this degree discipline 12\textsuperscript{th} among the 23 engineering disciplines tracked\textsuperscript{7}. Of the 23 engineering disciplines tracked by ASEE, Look College awards degrees in 15 of the disciplines. Proposed B.S. programs in Materials Science and...
Engineering; Environmental Engineering; Multidisciplinary Technology and Interdisciplinary Studies will increase our engineering discipline numbers to 19.

Figure 6. Bachelor’s Degrees Awarded by Discipline 2014, ASEE


Nationally, degrees awarded have showed incremental increases with steady positive production of graduates at all levels (B.S., M.S., and Ph.D.). According to ASEE, bachelor’s degrees grew by six percent (6%) during the past year in all engineering areas continuing a decade-long increase. Most engineering disciplines saw gains between three percent (3%) and six percent (6%) during the past year. Materials Science and Engineering saw an overall increase in B.S. degrees awarded of twenty-five percent (25%) between 2010 and 2014 as shown in Figure 7. At the masters level, degrees awarded increased by almost fifty percent (50%), while doctorates experienced approximately a twenty-three percent (23%) increase in the number of Ph.D.s awarded between 2010 and 2014. This consistent growth in materials science and engineering programs provides more evidence for the need to establish a B.S. program at Texas A&M University.
Figure 7. National Degrees Awarded in Materials Science and Engineering, 2010-2014

Yoder, Brian, (2014). Engineering By the Numbers, American Society for Engineering
ASEE Engineering Data Management System, 2015

The Texas A&M University Student Survey

The MSEN Department initiated a survey of undergraduate students enrolled in a series of selected lower level science and engineering classes to gauge interest in a B.S. degree in materials science and engineering. The courses surveyed were Physics 208 and 218, Chemistry 101, 103, and 107, MEEN 222, 360, and 475, and ENGR 111 and 112. Approximately 1,000 students responded to the survey (see Appendix C for the Texas A&M University Student Survey).

Almost twenty-nine percent (29%) of the student reported they would have considered a major in MSEN as one of their top 3 or first choice as a major. Over sixty percent (60%) of the students surveyed would have explored or considered a major in materials science and engineering. Fifty percent (50%) of the students surveyed reported they were interested in materials science and engineering and almost twenty percent (20%) reported being very interested. The majority of students surveyed were in their sophomore or junior year while just over thirty percent (33.7%) were seniors or had completed more than 90 credit hours.

This interest from current students is moderated by the fact that they are not currently exposed to materials science as undergraduates in their entry level engineering courses. Once the B.S. degree is approved, MSEN would participate in undergraduate recruitment activities during the freshman year and provide materials science and engineering educational units for the general level engineering courses.
Supply of Graduates in Texas

There are currently three institutions of higher education in Texas awarding Bachelors of Science in materials science and engineering. Table 6 shows the degrees awarded by year and level for materials science and engineering programs in the state of Texas. Combined, these degree-granting institutions are producing about 30 B.S. degrees each year:

- University of North Texas
- University of Texas–El Paso (Metallurgy)
- Rice University

Table 6. B.S., M.S., Ph.D. Degrees Awarded in Materials Science and Engineering in Texas, 2010-2014

<table>
<thead>
<tr>
<th>University</th>
<th>Program Name</th>
<th>Degree</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice University **</td>
<td>Materials Science</td>
<td>B.S.</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.S.</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph.D.</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Texas A&amp;M University</td>
<td>Materials Science and Engineering</td>
<td>M.S.</td>
<td>4 1</td>
<td>4 1</td>
<td>9 1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph.D.</td>
<td>5 1</td>
<td>9 1</td>
<td>24 1</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Texas State University</td>
<td>Materials Science, Engineering, and Commercialization</td>
<td>M.S.</td>
<td>1</td>
<td>6</td>
<td>8</td>
<td>2</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph.D.</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>University of Houston</td>
<td>Materials Science and Engineering</td>
<td>M.S.</td>
<td>1</td>
<td>6</td>
<td>8</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph.D.</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>*</td>
</tr>
<tr>
<td>University of North Texas</td>
<td>Materials Science and Engineering</td>
<td>B.S.</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.S.</td>
<td>4</td>
<td>7</td>
<td>8</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph.D.</td>
<td>3</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>University of Texas at Arlington</td>
<td>Materials Science and Engineering</td>
<td>M.S.</td>
<td>17</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph.D.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>University of Texas at Austin</td>
<td>Materials Science and Engineering</td>
<td>M.S.</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph.D.</td>
<td>11</td>
<td>8</td>
<td>12</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>University of Texas at Dallas</td>
<td>Materials Science and Engineering</td>
<td>M.S.</td>
<td>3</td>
<td>9</td>
<td>12</td>
<td>10</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph.D.</td>
<td>4</td>
<td>3</td>
<td>9</td>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>University of Texas at El Paso</td>
<td>Metallurgical and Materials</td>
<td>B.S.</td>
<td>19</td>
<td>18</td>
<td>25</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>University of Texas at San Antonio</td>
<td>Materials Science and Engineering</td>
<td>M.S.</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph.D.</td>
<td>4</td>
<td>2</td>
<td>11</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

1 Degrees Awarded from the Interdisciplinary Program in College of Engineering at TAMU
* Data unavailable
** Data Source: National Center for Educational Statistics, 2012-13
Primary Source: ASEE Engineering Data Management System, 2015

More strikingly, the State of Texas significantly lags behind in producing adequate numbers of B.S. graduates in materials science and engineering compared to other large economy states. As mentioned above, Texas only has three (3) undergraduate programs while California has seven (7) undergraduate programs in materials science and engineering, Ohio has six (6), and Pennsylvania has six (6) programs. The enrollment and the numbers of B.S. graduates from those programs have increased 5% annually over the last five years while the existing number of graduates from Texas remained nearly constant over that
same period (24 degrees in 2010, 18 in 2011, 36 in 2012, 22 in 2013, and 33 in 2014, see Table 6). Therefore, there is a need for an undergraduate program in a flagship Texas school to produce enough B.S. graduates to serve the Texas economy and satisfy demand.

Below, Figure 8 shows the trends in B.S. degrees awarded in other large states such as California, Illinois, Ohio, and Pennsylvania.

Figure 8. Historic B.S. Degrees Awarded in Materials Science and Engineering by Selected State, 2010-2014
Source: ASEE Engineering Data Management System, 2014
C. **Enrollment Projections** – Use this table to show the estimated cumulative headcount and full-time student equivalent (FTSE) enrollment for the first five years of the program. *(Include majors only and consider attrition and graduation.)*

The Dwight Look College of Engineering currently admits freshmen into the general engineering program whereby most students follow a common first-year engineering curriculum. The same first-year curriculum will be required for the B.S. MSEN degree program. Students interested in the proposed B.S. MSEN degree program will apply using the same entry-to-a-major process for all existing engineering majors. Because the large majority of engineering majors are full-time students, it is assumed that most B.S. MSEN majors will be full-time students.

It is expected that the proposed B.S. materials science and engineering program will initially be limited to a small number of students (50 new sophomore students in the first year). The first-year engineering unified curriculum required by the Look College provides a one-year lead-time to recruit and populate appropriate second-year and third-year courses as enrollment progresses. Initial enrollments will come primarily from the current residential headcount as students migrate in from other majors or from the Freshmen Engineering program or transfer from Look College community college programs throughout the state. We expect the process of establishing a full program with complete course offerings would occur over a five-year period. A comprehensive recruitment program in years 1 and 2 will focus on attracting domestic students from Texas, and in particular, among the underrepresented student groups and first-generation college students. As it matures, the MSEN undergraduate program would like to accept 100 undergraduate students per year. Table 7 illustrates a projected number of 300 undergraduate students with an eighty-five percent (85%) retention rate and an average graduation time of less than 4.5 years.

**Table 7. Enrollment Projections for the Proposed Bachelor of Science Degree Program at Texas A&M University**

<table>
<thead>
<tr>
<th>Year</th>
<th>Change of Major/Transfers</th>
<th>New Students</th>
<th>Attrition</th>
<th>Graduation</th>
<th>Cumulative Headcount</th>
<th>Cumulative FTES (<em>new only</em>)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>60</td>
<td>3</td>
<td>0</td>
<td>122</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>80</td>
<td>7</td>
<td>0</td>
<td>215</td>
<td>138</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>80</td>
<td>11</td>
<td>42</td>
<td>262</td>
<td>213</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>80</td>
<td>13</td>
<td>64</td>
<td>285</td>
<td>231</td>
</tr>
</tbody>
</table>

Request for New B.S. Degree Program
Page 20
II. Quality

A. **Degree Requirements** – Use this table to show the degree requirements of the program. *(Modify the table as needed; if necessary, replicate the table for more than one option.)*

Table 8 is a summary of the proposed degree requirements for the B.S. MSEN program. These requirements are subdivided into major categories. A justification for exceeding the 120-hour SCH limit is provided. The general body of knowledge includes the first year mathematics/science/engineering sequence common to all engineering undergraduates (27 SCH). Required MSEN Core Courses consist of 59 SCH of additional courses necessary to fulfill the University Core Curriculum (UCC) 24 SCH. Nine hours of directed MSEN technical electives and additional nine hours of specialty technical area electives are included in the B.S. MSEN program. The specialty technical electives will include courses relevant to materials science and engineering. Given our constituent interdisciplinary culture, some courses will be taught from other departments such as biomaterials courses from the biomedical engineering department, energy related materials courses from the chemical engineering and chemistry departments, electronic materials courses from the electrical engineering and physics departments, etc. Because of the very interdisciplinary nature of materials science and engineering, these specialty technical electives will provide flexibility for interested students to get a well-rounded education in an interdisciplinary environment.

**Table 8. Proposed Degree Requirements for a Bachelor of Science in Materials Science and Engineering at Texas A&M University**

<table>
<thead>
<tr>
<th>Category</th>
<th>Semester Credit Hours</th>
<th>Clock Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education Core Curriculum <em>(bachelor's degree only)</em></td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>MSEN Core Courses</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>MSEN Technical Electives</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Specialty Technical Electives</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Other <em>(Specify, e.g., internships, clinical work)</em></td>
<td><em>(if not included above)</em></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>128</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Note: A Bachelor degree should not exceed 120 Semester Credit Hours (SCH) per Board rule 5.44 (a) (3). Those that exceed 120 SCH must provide detailed documentation describing the compelling academic reason for the number of required hours, such as programmatic accreditation requirements, statutory requirements, or licensure/certification requirements that cannot be met without exceeding the 120-hour limit.*

We request a waiver to exceed the required 120 SCH maximum for a Bachelor’s program so that this program is on par with existing engineering programs in the Dwight Look College of Engineering. The 128 SCH requirement for our existing engineering programs will satisfy ABET requirements for depth and breadth in the engineering discipline, math and science, and satisfy the core curriculum requirements. The 128 SCH requirement has helped position seven current B.S. degree programs offered by the Dwight Look College of Engineering to be ranked among the top 10 programs offered by public institutions in the nation. The proposed B.S. in MSEN will require similar depth and breadth to satisfy ABET accreditation and core curriculum requirements.
Highlights
Proposed Bachelor of Science in Materials Science and Engineering

- **Flexibility** to engage in one or more of several defined emphasis areas, or with guidance of a faculty mentor, create a custom emphasis degree plan.
- **Opportunities** to participate in internships with industry partners, and research in academic and government laboratories.
- **Integration** of laboratory experience with computational materials science simulation.
- **Preparation** for employment as a professional engineer across a range of industries, including energy, biomedical, semiconductor, and defense.

Educational Objectives
MSEN graduates will be prepared to pursue careers as materials scientists and engineers, pursue advanced graduate study, or to apply their knowledge in other fields such as law, medicine or business. Graduates from our department will have the following skills:

- Apply fundamental materials processing, structure, properties, and performance relationships to identify and solve materials-related challenges.
- Master a broad suite of synthesis, characterization, and simulation techniques.
- Thrive in multidisciplinary engineering environments.
- Bridge the gap between fundamental research (science) and technology (engineering).
- Communicate effectively, both orally and in writing.
- Advance as future leaders in specific materials emphasis areas.
- Demonstrate an increased level of leadership and responsibility.
- Exhibit a commitment to professional ethics in their professional career.

Student Outcomes:

- An appropriate mastery of the knowledge, techniques, skills and modern tools of complex systems that span multiple engineering technology disciplines.
- An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology.
- An ability to conduct standard tests and measurements; to conduct, analyze and interpret experiments, and to apply experimental results to improve processes.
- An ability to apply creativity in the design of complex systems that span multiple engineering technology disciplines.
- An ability to function effectively on teams.
- An ability to identify, analyze and solve technical problems.
- An ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.
- An understanding of the need for and an ability to engage in self-directed continuing professional development.
- An ability to understand professional, ethical and social responsibilities.
- A respect for diversity and knowledge of contemporary professional, societal and global issues.
- A commitment to quality, timeliness, and continuous improvement.
B. **Curriculum** – Use these tables to identify the required courses and prescribed electives of the program. Note with an asterisk (*) courses that would be added if the program is approved. *(Add and delete rows as needed. If applicable, replicate the tables for different tracks/options.)*

The curriculum meets requirements specified by all stakeholders for our MSEN program. First, the curriculum satisfies the University’s Core Curriculum (UCC), shown in Table 9. Students in the major will complete all the courses needed to become well-rounded persons with knowledge of local, national, and global issues related to their major and society-at-large.

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>SCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>Life and Physical Science</td>
<td>6</td>
</tr>
<tr>
<td>Language, Philosophy and Culture</td>
<td>3</td>
</tr>
<tr>
<td>Creative Arts</td>
<td>3</td>
</tr>
<tr>
<td>American History</td>
<td>6</td>
</tr>
<tr>
<td>Government/Political Science</td>
<td>6</td>
</tr>
<tr>
<td>Social and Behavioral Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

The MSEN curriculum follows the common body of knowledge in mathematics/science/engineering sequence defined for all undergraduate engineering students. Table 10 lists the courses that students cover during the first year in mathematics/science/engineering. In addition to the required general body of knowledge for engineering, the college requires two UCC electives in the first year. The general body of knowledge courses teach students about fundamentals common to all engineering majors while they learn about each major in the college. Between the freshman and sophomore years, students apply for entry to a major.

Finally, students admitted to the Department of Materials Science and Engineering will follow the course sequence shown in Table 11.

<table>
<thead>
<tr>
<th>Fall</th>
<th>SCH</th>
<th>Pre/Co-reqs</th>
<th>Spring</th>
<th>SCH</th>
<th>Pre/Co-reqs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 151 - Eng. Math I</td>
<td>4</td>
<td></td>
<td>MATH 150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 101/111 - Fund. Chem I</td>
<td>4</td>
<td></td>
<td>CHEM 102/112 - Fund. Chem II</td>
<td>4</td>
<td></td>
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<tr>
<td>ENGR 111 - Found. of Eng.</td>
<td>2</td>
<td></td>
<td>PHYS 218 - Mechanics</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>ENGL 104 - Comp &amp; Rhetoric</td>
<td>3</td>
<td></td>
<td>ENGR 112 - Found. of Eng.</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

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Table 11. Bachelor of Science Degree Program in Materials Science and Engineering by Semester

**Degree Plan in Materials Science and Engineering**  
**FRESHMAN YEAR (Common Engineering First Year)**

<table>
<thead>
<tr>
<th>Fall</th>
<th>SCH</th>
<th>Pre/Co-reqs</th>
<th>Spring</th>
<th>SCH</th>
<th>Pre/Co-reqs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 151* - Eng. Math I</td>
<td>4</td>
<td>MATH 150</td>
<td>MATH 152° - Eng. Math II</td>
<td>4</td>
<td>MATH 151</td>
</tr>
<tr>
<td>ENGR 111° - Found. of Eng.</td>
<td>2</td>
<td></td>
<td>PHYS 218° - Mechanics</td>
<td>4</td>
<td>MATH 151</td>
</tr>
<tr>
<td>ENGL 104 - Comp &amp; Rhetoric</td>
<td>3</td>
<td></td>
<td>ENGR 112° - Found. of Eng.</td>
<td>2</td>
<td>ENGR 111</td>
</tr>
<tr>
<td>UCC Elective</td>
<td>3</td>
<td></td>
<td>UCC Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16</td>
<td></td>
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<td>17</td>
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</table>

**SOHOMORE YEAR**

<table>
<thead>
<tr>
<th>Fall</th>
<th>SCH</th>
<th>Pre/Co-reqs</th>
<th>Spring</th>
<th>SCH</th>
<th>Pre/Co-reqs</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 208° - Elect. and Optics</td>
<td>4</td>
<td>PHYS 218</td>
<td>MATH 307° - Analytical Mthds for Materials Sci Engineering</td>
<td>3</td>
<td>MATH 251</td>
</tr>
<tr>
<td>MATH 251° - Eng Math III</td>
<td>3</td>
<td>MATH 152</td>
<td>MSEN 240° - Kinetics of Materials</td>
<td>3</td>
<td>MSEN 210</td>
</tr>
<tr>
<td>MSEN 201° - Fundamentals of Materials</td>
<td>3</td>
<td>PHYS 218, CHEM 101/107</td>
<td>MSEN 250° - Soft Matter</td>
<td>3</td>
<td>PHYS 208, CHEM 102/112</td>
</tr>
<tr>
<td>MSEN 210° - Thermodynamics of Materials</td>
<td>3</td>
<td>MSEN 201</td>
<td>MSEN 310° - Structure of Materials</td>
<td>3</td>
<td>MSEN 201</td>
</tr>
<tr>
<td>MSEN 220° - Chemistry &amp; Physics of Inorganic Materials (in future CHEM/MSEN)</td>
<td>3</td>
<td>PHYS 218, CHEM 102</td>
<td>MSEN 301° - Unified Materials Lab 1°</td>
<td>3</td>
<td>MSEN 240, MSEN 310</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MSEN 281° - Materials Seminar</td>
<td>1</td>
<td>MSEN 201</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16</td>
<td></td>
<td></td>
<td>16</td>
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</tbody>
</table>

**JUNIOR YEAR**

<table>
<thead>
<tr>
<th>Fall</th>
<th>SCH</th>
<th>Pre/Co-reqs</th>
<th>Spring</th>
<th>SCH</th>
<th>Pre/Co-reqs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSEN 460° - Functional Materials Prop</td>
<td>3</td>
<td>MSEN 220, MSEN 310</td>
<td>MSEN 370° - Intro to Computational Materials Sci Eng</td>
<td>3</td>
<td>MSEN 210, MSEN 330</td>
</tr>
<tr>
<td>MSEN 302° - Unified Materials Lab 2°</td>
<td>3</td>
<td>MSEN 301</td>
<td>UCC Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MSEN 330° - Num Mthds for Mat Sci Eng</td>
<td>3</td>
<td>MSEN 230</td>
<td>MSEN 400° - Design Analysis Mat Exp</td>
<td>3</td>
<td>MSEN 220, MSEN 302, MSEN 320</td>
</tr>
<tr>
<td>MSEN Tech Elective 1°</td>
<td>3</td>
<td></td>
<td>UCC Comm. Elective (COMM 205 or ENGL 210)</td>
<td>3</td>
<td>Specialty Elective 1</td>
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<td>17</td>
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</table>

**SENIOR YEAR**

<table>
<thead>
<tr>
<th>Fall</th>
<th>SCH</th>
<th>Pre/Co-reqs</th>
<th>Spring</th>
<th>SCH</th>
<th>Pre/Co-reqs</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 482° - Ethics &amp; Eng°°</td>
<td>3</td>
<td></td>
<td>MSEN 402° - Materials Research Design II</td>
<td>3</td>
<td>MSEN 401</td>
</tr>
<tr>
<td>MSEN 401° - Materials Research Design I</td>
<td>3</td>
<td>MSEN 281, MSEN 340, MSEN 400</td>
<td>MSEN Tech Elective 3°</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MSEN 480° - Communicating Mater. Sci Eng</td>
<td>1</td>
<td>MSEN 401</td>
<td>Specialty Elective 3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MSEN Tech Elective 2°</td>
<td>3</td>
<td></td>
<td>UCC Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Specialty Elective 2</td>
<td>3</td>
<td></td>
<td>UCC Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>UCC Elective</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16</td>
<td></td>
<td></td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

**co-rec**  
° or placement exam  
°° writing intensive class  
°°° communications intensive class  
* require a 'C' or better for progress towards MSEN  
TBD - To be developed  

**Engineering First Year**  
27 SCH  
**UCC Electives**  
24 SCH  
**MSEN Core**  
59 SCH  
**MSEN Technical Electives**  
9 SCH  
**Specialty Technical Electives**  
9 SCH  
**Total**  
128 SCH

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Core MSEN Courses

The materials science and engineering core courses build on a strong foundation of chemistry, physics, and mathematics, required to explore the fundamental concepts and techniques that are critical to materials science and engineering. The core sequence has these strengths:

- The unified materials laboratories offer practical experiential learning combined with theory application in materials processing, characterization, and simulation that runs from sophomore year through the capstone senior design sequence.
- The course sequence emphasizes written and oral communication skills essential for practicing scientists and engineers.
- Quantitative and predictive computational materials science method courses introduce methods that are rapidly invigorating the field.
- The senior capstone design courses offer flexibility: students may apply the scientific research process, or contribute to a team-based materials design challenge working on a real world problem sponsored by industrial partners.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSEN 201</td>
<td>Fundamentals of Materials Science and Engineering. Credit 3. (3-0)</td>
<td>existing</td>
</tr>
<tr>
<td>MSEN 210</td>
<td>Thermodynamics of Materials. Credit 3. (3-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 220</td>
<td>Chemistry and Physics of Inorganic Materials. Credit 3. (3-0) (To be cross listed as CHEM/MSEN 220 in the future)</td>
<td>new</td>
</tr>
<tr>
<td>MATH 307</td>
<td>Analytical Methods for Materials Scientists and Engineers. Credit 3. (3-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 240</td>
<td>Kinetics of Materials. Credit 3. (3-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 250</td>
<td>Soft Matter. Credit 3. (3-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 281</td>
<td>Materials Seminar. Credit 1. (1-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 301</td>
<td>Unified Materials Lab I. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 302</td>
<td>Unified Materials Lab II. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 310</td>
<td>Structure of Materials. Credit 3 (3-0)</td>
<td>existing</td>
</tr>
<tr>
<td>MSEN 320</td>
<td>Deformation and Failure Mechanisms in Engineering Materials. Credit 3. (3-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 330</td>
<td>Numerical Methods for Materials Scientists and Engineers. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 340</td>
<td>Case Studies in Materials. Credit 2. (2-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 370</td>
<td>Introduction to Computational Materials Science and Engineering. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 400</td>
<td>Design and Analysis of Materials Experiments. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 401</td>
<td>Materials Research and Design I. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 402</td>
<td>Materials Research and Design II. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 460</td>
<td>Properties of Functional Materials. Credit 3. (3-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 480</td>
<td>Communicating Materials Science and Engineering. Credit 1. (1-0)</td>
<td>new</td>
</tr>
</tbody>
</table>
Elective MSEN Courses

Students have 18 SCH of elective courses — 9 SCH MSEN technical electives and 9 SCH specialty technical electives — to develop a flexible curriculum enhancing students’ experience enabling students to pursue interests complementary to their chosen major. Together with a Faculty Mentor/Advisor, students will create individualized degree plans that might center on (but are not limited to) one or more of the following emphasis areas:

- Polymers and Soft Materials
- Computational Materials Science
- Corrosion Engineering
- Materials Design, Processing and Characterization
- Structural Materials

Selecting an area of emphasis is not a requirement, but an option. Emphasis areas normally involve taking nine (9) technical elective hours. With nine (9) specialty elective hours, students may also choose to pursue a second specialization area. Alternatively, they may choose to use specialty elective hours to complement and strengthen their selected single emphasis area. For example, students specializing in corrosion engineering may take three (3) foundational corrosion courses, and any specialty technical electives in the areas related to corrosion, such as mechanics, fracture mechanics, fatigue, or coatings. Students specializing in polymers and soft materials may strengthen their specialization by adding courses in composites, or practical lab-based polymer courses. Students will also have the ability to increase the fundamentals of a broad materials science and engineering degree through using these specialty electives to strengthen their core knowledge in the basics of ceramics, polymers, composites, or metals.

Table 13. MSEN Technical Classes with Course Numbers, Titles and Status

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSEN 410</td>
<td>Materials Processing. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 415</td>
<td>Defects in Solids. Credit 3. (3-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 420</td>
<td>Polymer Science. Credit 3. (3-0)</td>
<td>existing</td>
</tr>
<tr>
<td>MSEN 426</td>
<td>Polymer Laboratories. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 430</td>
<td>Nanomaterials Science. Credit 3. (3-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 440</td>
<td>Materials Electrochemistry and Corrosion. Credit 3. (3-0)</td>
<td>existing</td>
</tr>
<tr>
<td>MSEN 444</td>
<td>Corrosion and Electrochemistry Laboratory. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 446</td>
<td>Corrosion Prevention and Control Methods. Credit 3. (3-0)</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 458</td>
<td>Fundamentals of Ceramics. Credit 3. (3-0)</td>
<td>stack (w/ existing)</td>
</tr>
<tr>
<td>MSEN 462</td>
<td>Advanced Materials Characterization. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 472</td>
<td>Atomistic Simulation of Materials. Credit 3. (3-0)</td>
<td>stack (w/ existing)</td>
</tr>
<tr>
<td>MSEN 474</td>
<td>Materials Modeling of Phase Transformation and Microstructural Evolution. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 476</td>
<td>Multi-scale Computations Materials Science. Credit 3. (2-3)</td>
<td>Lab</td>
</tr>
<tr>
<td>MSEN 484</td>
<td>Internship. Credit 0-4.</td>
<td>new</td>
</tr>
<tr>
<td>MSEN 485</td>
<td>Directed Studies. Credit 0-4.</td>
<td>existing</td>
</tr>
<tr>
<td>MSEN 491</td>
<td>Research. Credit 0-4.</td>
<td>existing</td>
</tr>
<tr>
<td>MEEN 455</td>
<td>Engineering with Plastics. Credit 3. (3-0)</td>
<td>existing: MEEN</td>
</tr>
<tr>
<td>MEEN 458</td>
<td>Processing and Characterization of Polymers. Credit 3 (3-0)</td>
<td>existing: MEEN</td>
</tr>
<tr>
<td>MEEN 471</td>
<td>Elements of Composite Materials. Credit 3 (3-0)</td>
<td>existing: MEEN</td>
</tr>
</tbody>
</table>
C. **Faculty** – Use these tables to provide information about Core and Support faculty. Add an asterisk (*) before the name of the individual who will have direct administrative responsibilities for the program.

**Program Faculty**
The Bachelor of Science faculty in MSEN are the faculty with more than 0% full-time equivalent (FTE) appointment in the Department of Materials Science and Engineering. The names and information of the program faculty members, address the ABET Faculty Criterion.

**Table 14. Core Faculty in Materials Science and Engineering at Texas A&M University**

<table>
<thead>
<tr>
<th>Name of Core Faculty and Faculty Rank</th>
<th>Highest Degree and Awarding Institution</th>
<th>Courses Assigned in Program</th>
<th>% Time Assigned To Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arroyave, Raymundo Associate Professor</td>
<td>Ph.D. Materials Science; Massachusetts Institute of Technology; Cambridge, MA**</td>
<td>MSEN 210; MSEN 240.</td>
<td>50%</td>
</tr>
<tr>
<td>Benzerga, Amine Associate Professor</td>
<td>Ph.D., Material Science &amp; Engineering, Ecole des Mines de Paris, France**</td>
<td>MSEN 474.</td>
<td>15%</td>
</tr>
<tr>
<td>Cagin, Tahir Professor</td>
<td>Ph.D. Physics, Clemson University, Greenville, SC**</td>
<td>MSEN 220.</td>
<td>50%</td>
</tr>
<tr>
<td>Castaneda-Lopez, Homero Associate Professor</td>
<td>Ph.D. Materials Science and Eng., Penn State University, University Park, PA**</td>
<td>MSEN 444; MSEN 446.</td>
<td>50%</td>
</tr>
<tr>
<td>Creasy, Terry Associate Professor</td>
<td>Ph.D. Mechanical Engineering, University of Delaware **</td>
<td>MSEN 301; MSEN 302; MSEN 458; MSEN 471.</td>
<td>50%</td>
</tr>
<tr>
<td>Demkowicz, Michael Associate Professor</td>
<td>Ph.D. Mechanical Engineering, Massachusetts Institute of Technology**</td>
<td>MSEN 415; MSEN 484.</td>
<td>50%</td>
</tr>
<tr>
<td>Hartwig, K. Ted Professor</td>
<td>Ph.D. Metallurgical Engineering University of Wisconsin, Madison** PE (Texas)</td>
<td>MSEN 340; MSEN 400; MSEN 480.</td>
<td>35%</td>
</tr>
<tr>
<td>*Karaman, Ibrahim Chevron Professor and Department Head</td>
<td>Ph.D. Mechanical Engineering, University of Illinois, Urbana-Champaign, Illinois**</td>
<td>MSEN 201; MSEN 430.</td>
<td>50%</td>
</tr>
<tr>
<td>Lin, Pao-Tai Assistant Professor</td>
<td>Ph.D., Materials Science and Engineering, Northwestern University**</td>
<td>MSEN 460.</td>
<td>15%</td>
</tr>
<tr>
<td>Needleman, Alan TEES Distinguished Professor</td>
<td>Ph.D., Harvard University**</td>
<td>MSEN 120.</td>
<td>35%</td>
</tr>
</tbody>
</table>
### Table 14. Continued. Core Faculty in Materials Science and Engineering at Texas A&M University

<table>
<thead>
<tr>
<th>Name of Core Faculty and Faculty Rank</th>
<th>Highest Degree and Awarding Institution</th>
<th>Courses Assigned in Program</th>
<th>% Time Assigned to Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qian, Xiaofeng Assistant Professor</td>
<td>Ph.D. Nuclear Science and Engineering, Massachusetts Institute of Technology, Cambridge, MA**</td>
<td>MSEN 330; MSEN 472.</td>
<td>50%</td>
</tr>
<tr>
<td>*Radovic, Miladin Associate Professor and Associate Department Head</td>
<td>Ph.D., Materials Science and Engineering, Drexel University, Philadelphia, PA**</td>
<td>MSEN 410; MSEN 458.</td>
<td>50%</td>
</tr>
<tr>
<td>Shamberger, Patrick Assistant Professor</td>
<td>Ph.D. Materials Science and Engineering, University of Washington; Seattle, WA**</td>
<td>MSEN 310; MSEN 462.</td>
<td>50%</td>
</tr>
<tr>
<td>Srivastava, Ankit Assistant Professor</td>
<td>Ph.D. Materials Science and Engineering, University of North Texas, Denton, TX**</td>
<td>MSEN 230; MSEN 370.</td>
<td>50%</td>
</tr>
<tr>
<td>Sue, Hung-Jue TEES Professor</td>
<td>Ph. D. Macromolecular Science and Engineering Program, The University of Michigan, Ann Arbor, MI**</td>
<td>MSEN 426; MSEN 455.</td>
<td>50%</td>
</tr>
<tr>
<td>Sukhishvili, Svetlana Professor</td>
<td>Ph.D. Polymer Chemistry, Moscow State University, Russia**</td>
<td>MSEN 250; MSEN 420.</td>
<td>50%</td>
</tr>
<tr>
<td>Talreja, Ramesh Professor</td>
<td>PhD and Doctor of Technical Sciences degree, Technical University of Denmark**</td>
<td>MSEN 401; MSEN 402.</td>
<td>15%</td>
</tr>
</tbody>
</table>

**Faculty have been certified following the Texas A&M University Faculty Credentials Guidelines, the Southern Association of College and Schools Commission on Colleges (SACSCOC), and all ABET guidelines.

### Table 15. Support Faculty in Materials Science and Engineering at Texas A&M University

<table>
<thead>
<tr>
<th>Name of Core Faculty and Faculty Rank</th>
<th>Highest Degree and Awarding Institution</th>
<th>Courses Assigned in Program</th>
<th>% Time Assigned to Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

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D. **Students** – Describe general recruitment efforts and admission requirements. In accordance with the institution’s Uniform Recruitment and Retention Strategy, describe plans to recruit, retain, and graduate students from underrepresented groups for the program.

The Look College admits all entering freshmen into a general engineering pool for which most students follow a common freshman year. Students may apply to the Bachelor of Science in Materials Science and Engineering degree program through the College entry-to-a-major (ETAM) process, as early as their second semester of study. Materials Science and Engineering Students will be admitted according to the Look College guidelines and in addition, the MSEN department will employ the following strategies:

a) Details for applying to the B.S. MSEN degree program will be made known to students consistent with the process for informing all Engineering students about the ETAM process.

b) Interested engineering students are required to meet with the Director of Undergraduate Degree Programs and the undergraduate program coordinator to discuss the program’s purpose and identify the student’s interests in the MSEN degree program.

c) Students then submit a tentative degree plan to the Director of Undergraduate Degree Programs and MSEN Admission Committee for review.

d) Steps (b) and (c) above must be completed before students apply to the B.S. MSEN degree program. The Director of Undergraduate Degree Programs will oversee the review process for the ETAM MSEN applications. Admission into the B.S. MSEN degree program will be based on a comprehensive review of the ETAM application by the MSEN Admission Committee.

e) To be eligible for the program, students must have completed an engineering course (e.g., ENGR 111), a science course, and a mathematics course in an existing engineering curriculum at Texas A&M University. In addition, students must have a minimum overall Texas A&M University grade point average (GPA) of 2.0 at the time of entry.

Students applying to the Bachelor of Science in Materials Science and Engineering degree from other Look College Departments and College of Science through a change of curriculum request will be considered if the following two conditions are satisfied: (1) the student has completed less than 70% of the curriculum in an engineering degree program (including freshman engineering courses and core curriculum courses), and (2) the student has an overall Texas A&M University GPA no less than 3.25. Transfer students will not be given credit toward the degree program for courses in which a grade less than C was received. The Director of Undergraduate Degree Programs will oversee the change of curriculum process.

MSEN will leverage the efforts of existing Look College programs to recruit, retain, and graduate students, including those from underrepresented groups (women, African American, Hispanic/ Latino, Native American) for the B.S. program. For example, one effort will utilize the Engineering Academies program, which is a partnership with two-year institutions around the state of Texas. This program offers students simultaneous co-enrollment in the TAMU Look College and a partner two-year institution. Several of the partner institutions are Hispanic serving and minority serving institutions and therefore represent the growing underrepresented minority population in the state of Texas and the country. Another program is the ENGAGE (Engineering Aggies Gaining Experience) program. This program seeks to increase the number of underrepresented minority students and women in the Look College through established partnerships with 37 Texas high schools. Some of the widespread activities within this program include invitational events for 10th to 12th grade students, the Aggieland Saturday Open House, High School Counselor Retreats, Summer Engineering Camps, and Peer Mentor opportunities. A third program is the Women in Engineering (WE) Program. This program offers outreach, recruitment and retention to female students entering engineering degree programs. It helps increase the percentage of women in engineering through WE IDEAS summer camps and “choosing a major” events. Finally, to help increase student retention, students in the B.S. MSEN program will be encouraged to participate in the Engineering Living Learning Community Program. This program houses approximately 650 engineering students and creates

Request for New B.S. Degree Program
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a community of scholars. The community helps the overall transition to college through small focus-group interactions, second year peer mentors that also reside in the dorms, and by emphasizing a commitment to academic excellence.

In summary, Look College recruitment and enrichment programs and retention activities include:

**Recruitment**
- Aggieland Saturday
- Student Ambassadors
- National Scholars
- Military Veterans (AggiE-Vets)
- Graduate Students
- Transferring into Engineering
- Engineering Living Learning Community

**Retention Activities**
- Academic Support Services
- ENGR 111 and 112 Help Sessions
- Engineering Living Learning Community
- Military Veterans (AggiE-Vets)
- Scholarships
- Success Program
- Y2 RISE (Resources for second-year students)
- Supplemental Instruction (Department of Mathematics Programs)
- Academic Support Services (Peer Tutoring, Office Hours, Success Program (Resources for first generation and economically disadvantaged students)

**Enrichment**
- Study Abroad
- Engineering Organizations
- Certificate Programs
- Undergraduate Research
- Engineering Honors
- Design Competitions
- FE Exam
- Graduate Students
- Zachry Leadership Program

E. **Library** – Provide the library director’s assessment of library resources necessary for the program. Describe plans to build the library holdings to support the program.

Existing Library Resources are sufficient and will be used to support ABET Facilities Criterion. The library services and the computing and information infrastructure at Texas A&M is adequate to support the scholarly and professional activities of the MSEN students and faculty.

Characteristics of the Texas A&M University Libraries:

- approximately 4 million volumes, with 400,000 e-books.
- Ranks 2nd in nation for electronic serials expenditures*.
- Ranks 13th among academic libraries in U.S. public institutions*.
- Spent $32.6 million in total library expenditures in 2008*.

* According to Association of Research Libraries (ARL) statistics
F. **Facilities and Equipment** – Describe the availability and adequacy of facilities and equipment to support the program. Describe plans for facility and equipment improvements/additions.

The Look College is presently building a transformative education space: the Zachry Engineering Education Center. This 550,000 square feet building will provide state-of-the-art space and equipment for transformative learning and discovery. The center is scheduled to be completed by Fall 2017.

The Materials Science and Engineering department is leading the Materials Laboratory design effort to assure that undergraduates in MSEN and other majors will have advanced materials processing, testing, and design space. The Materials Laboratory, 3800 square feet, will house equipment for all aspects of materials education from invention to inspection. The equipment plan includes thermo-physical evaluation, scanning electron microscopy, and small scale manufacturing stations to address student needs for the next ten (10) years of technology advancement. The EEC has eight (8) additional laboratories that students can access for cross-disciplinary education. In addition, the building will have open collaboration spaces where students can assemble in teams to conduct materials design projects. To complete the EEC, the department will support the capstone design sequence with a collaboration workroom and an instrumentation space for seniors in the major to work on major design projects. Finally, faculty within the department have research laboratories with novel, and advanced devices at the forefront of engineering research and education. Undergraduate students in honors and research courses can access these facilities to enhance their education as they contribute to advancing the body of knowledge in advanced materials science and engineering.

Furthermore, the newly established 16,000 sq. ft. Engineering Innovation Center (EIC) in the College is well equipped to support interdisciplinary interactions among undergraduate students at various stages of the program. EIC resources include more than 7,000 sq. ft. of multiuser collaboration spaces available to students for extended hours including weekends; it includes a 5,600 sq. ft. fabrication area with access to 3D printing, laser cutters, lathes and mills to support the development of multidisciplinary team project prototypes, and access to conference rooms for remote collaborations with industry. Furthermore, EIC offers student access to informal programs such as Aggies Invent and Pop-Up Classes that promote collaborations across majors, innovation, and entrepreneurship.

In addition, the MSEN department will house a 1,500 sq. ft. undergraduate lab space in the Reed McDonald Building for materials processing experiments that the aforementioned facilities will not have. This laboratory will be established and maintained using differential tuition funds.

Materials Science and Engineering faculty will chair the materials laboratory committee and use differential tuition funds to keep all the materials laboratories updated with equipment as the technology continues to advance. Research laboratories undergo continuous improvement to keep pace with state, national, and world needs. In addition, these facilities will be used in combination with the library, and computing and information infrastructure to support ABET Facilities Criterion.

G. **Accreditation** – If the discipline has a national accrediting body, describe plans to obtain accreditation or provide a rationale for not pursuing accreditation.

ABET, incorporated as the Accreditation Board for Engineering and Technology, Inc., is a nongovernmental organization that accredits post-secondary education programs in "applied science, computing, engineering, and engineering technology"\(^{16}\). The MSEN program curriculum is designed to meet the General Criteria of the Engineering Accreditation Commission of ABET. The applicable criteria for materials science and engineering are the program criteria for Materials, Metallurgical, Ceramics and similarly named engineering programs. The lead society from which program evaluators are appointed is
The Minerals, Metals & Materials Society (TMS). ABET requires that an institution seeking accreditation for a new engineering degree program apply for an accreditation visit in the first fall after students have graduated from the new degree program. Further, an institution cannot seek accreditation until students have graduated from the new degree program. All other engineering programs in the Look College are accredited by the Engineering Accreditation Commission of ABET. The TAMU Look College is very familiar with expectations for accredited engineering programs. The College will use its experience with the accreditation process in seeking accreditation for the MSEN degree program at the appropriate time.

Current ABET curriculum requirements for Materials, Metallurgical, Ceramics and Similarly Named Engineering Programs follow:

"The curriculum must prepare graduates to apply advanced science (such as chemistry, biology and physics), computational techniques and engineering principles to materials systems implied by the program modifier, e.g., ceramics, metals, polymers, biomaterials, composite materials; to integrate the understanding of the scientific and engineering principles underlying the four major elements of the field: structure, properties, processing, and performance related to material systems appropriate to the field; to apply and integrate knowledge from each of the above four elements of the field using experimental, computational and statistical methods to solve materials problems including selection and design consistent with the program educational objectives." 16

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Adding the Bachelor of Science in Materials Science and Engineering at Texas A&M is necessary in order to increase our competitiveness in the key metrics contributing to the vision and mission of our University.

---

H. Evaluation – Describe the evaluation process that will be used to assess the quality and effectiveness of the new degree program.

The General Criteria of the Engineering Accreditation Commission of ABET include eight criteria: Students, Program Educational Objectives, Student Outcomes, Continuous Improvement, Curriculum, Faculty, Facilities, and Institutional Support. Within the Dwight Look College, institutional processes and resources that support applications for accreditation for existing engineering programs are available for the following criteria: Students, Facilities, and Institutional Support.

The criterion for Faculty 16 has been met by the outstanding engineering faculty across the Look College. MSEN will continue to recruit and hire faculty whose qualifications satisfy the criterion for Faculty. Program Educational Objectives 16 have been developed and are included in this application. They will be refined using continuous improvement methodology. We plan for regular review of the Program Educational Objectives by program stakeholders, including faculty, students and industry. In this way, the Program Educational Objectives criterion will be satisfied.

The Student Outcomes 16 criterion requires documented student outcomes that prepare graduates to attain the program educational objectives. These outcomes have been outlined and are included in this application. It is expected that this criterion will be satisfied upon additional documentation and review as the program matures. The requirements for the Curriculum 16 criterion were carefully considered in preparing the curriculum for the B.S. MSEN degree program. Utilizing the tools in a continuous improvement process, we plan for implementation of adjustments in the curriculum required. Therefore, it is expected that the Curriculum criterion will be satisfied.

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The final criterion is **Continuous Improvement**, which requires that there is a process to evaluate achievement of student outcomes and a process to improve achievement of student outcomes. There are several approaches to satisfying the Continuous Improvement criterion using a number of feedback mechanisms. The first will be course evaluations conducted by MSEN faculty teaching MSEN courses on a semester basis that will determine if the specific course objectives that are mapped to program outcomes have been met for each course. These data will then feed into a Learning Outcomes assessment across the entire program. Once each year, the Industrial Advisory Board, will review the Senior Capstone projects that MSEN students are engaged in to evaluate how each student learning outcome is being achieved. These two processes will guide the activities undertaken by the MSEN program to improve the curriculum and learning processes. In addition, the B.S. MSEN program will include information and feedback provided by the Graduating Senior Survey, the Departmental Advisor Form, Former Student Survey, and Employer Survey, as the program matures. Results from the evaluation could be used to alter the requirements on the courses used to satisfy the requirements for materials science and engineering topics and directed electives. Given the experience of the Look College with respect to the Continuous Improvement criterion, it is expected that the Continuous Improvement criterion will be satisfied.
III. **Costs and Funding**¹

Approximately fifty percent (50%) of the new MSEN curriculum will leverage current MSEN courses and Look College laboratories already in place. Most of the costs associated with the five-year startup plan for the MSEN program will be for the development and delivery of new (or highly modified) courses to support the new curriculum, including faculty salary, staff salary for student recruiting and enrollment advising, improved facilities and additional equipment.

The Faculty required to deliver the MSEN curriculum will grow from today’s 14 Full-Time-Equivalent (FTE) to 19 FTE (which includes three new full time tenure track faculty and two new non-tenure track professor of practice / lecturer) faculty over the five-year startup period to support program advising and new course development and delivery. From year three (3) to five (5), the need for lecturers will grow from one (1) to three (3) FTEs to support growth requirements for new sections of current and new MSEN courses. Graduate Assistant Teaching (GAT) support will grow to ten (10) in the first five years to accommodate additional lab sections of current and new lab courses. Administrative costs will include a full-time program coordinator beginning in year one (1). The five-year funding plan includes use of reallocated funds derived from the hiring of new faculty members who will focus on MSEN undergraduate courses. In addition to the estimated $945,000 of anticipated reallocated funds for faculty hiring, $2,037,868 will come from additional Differential Tuition (DT) funding that will be generated and used for non-tenure track professor of practice / lecturer salaries, full time program coordinator staff salary, GAT support, establishment of an undergraduate laboratory, procurement of new laboratory equipment, and lab supplies.

A. **Five-Year Costs and Funding Sources** - this table to shows five-year costs and sources of funding for the program.

<table>
<thead>
<tr>
<th>Five-Year Costs</th>
<th>Five-Year Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel¹</td>
<td>$2,003,200</td>
</tr>
<tr>
<td>Facilities and Equipment</td>
<td>$927,668</td>
</tr>
<tr>
<td>Library, Supplies, and Materials</td>
<td>$26,500</td>
</tr>
<tr>
<td>Other²</td>
<td>$25,500</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$2,982,868</td>
</tr>
</tbody>
</table>

1. Report costs for new faculty hires, graduate assistants, and technical support personnel. For new faculty, prorate individual salaries as a percentage of the time assigned to the program. If existing faculty will contribute to program, include costs necessary to maintain existing programs (e.g., cost of adjunct to cover courses previously taught by faculty who would teach in new program).
2. Specify other costs here (e.g., administrative costs, travel).
3. Indicate formula funding for students new to the institution because of the program; formula funding should be included only for years three through five of the program and should reflect enrollment projections for years three through five.
4. Report other sources of funding here. In-hand grants, "likely” future grants, and designated tuition and fees can be included.

¹ Please use the “Program Funding Estimation Tool” found on the CB website to correctly estimate state funding.
1. **Adequacy of Funding and Notification of Other Institutions** – The chief executive or chief academic officer shall sign the following statements:

I certify that the institution has adequate funds to cover the costs of the new program. Furthermore, the new program will not reduce the effectiveness or quality of existing programs at the institution.

I certify that my institution has notified all public institutions within 50 miles of the teaching site of our intention to offer the program at least 30 days prior to submitting this request. I also certify that if any objections were received, those objections were resolved prior to the submission of this request.

Chief Executive Officer/Chief Academic Officer          Date

2. **Board of Regents or Designee Approval** – A member of the Board of Regents or designee shall sign the following statement:

On behalf of the Board of Regents, I approve the program.

Board of Regents (Designee)          Date of Approval
APPENDICES

A. References.................................................................37
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APPENDIX A

References


APPENDIX B

Industry Survey

Emailed on October 1, 2015 - Summarized November 14, 2015

Materials Science and Engineering

Survey Overview

The College of Science and Engineering at Texas A&M University invites you to participate in the inaugural Industry Survey. This survey is designed to gather insights from companies and organizations about the roles they fill, the degree programs they value, and the skills they look for in new hires.

We encourage you to take a few minutes to share your knowledge and experiences with our students. The information you provide will help us maintain and improve our programs and offerings.

Bachelor of Science in Materials Science and Engineering

The BSE program is designed to provide students with a strong foundation in materials science and engineering. The curriculum is flexible and allows students to specialize in areas of interest.

About Your Organization

What is your company/organization's primary business activity? (Select all that apply)

- Aerospace
- Automotive
- Biotechnology
- Chemical Manufacturing
- Civil Engineering
- Electrical Engineering
- Electronics
- Environmental Science
- Finance

Where is your company/organization located?

Select one:

- Texas

About Your New Hires

From what science or engineering degree programs are you most interested in hiring new employees? (Select all that apply)

- Aerospace Engineering
- Biomedical Engineering
- Chemistry
- Civil Engineering
- Electrical Engineering
- Mechanical Engineering
- Materials Engineering
- Materials Science

Special Knowledge

Are you interested in hiring BS graduates with specialized knowledge in any of the areas listed below? (Select all that apply)

- Nanomaterials
- Nanotubes
- Conductors
- Ceramic Materials
- Advanced Materials
- Chemistry
- Energy/Ambience
- Fuels/Combustion
- Manufacturing
- Materials Science/Lightweight Materials
- Materials in Health and Safety
- Materials Processing
- Materials Testing
- Metallurgy
- Nanomaterials
- Polymers
- Properties/Characterization
- Science, Career/Technical

Texas A&M University

Request for New B.S. Degree Program

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New B.S. Degree

Do you believe a new Bachelor of Science in Materials Science and Engineering in Texas would be beneficial for the future of Texas and the Nation?
- [ ] Yes
- [ ] No
- [ ] Don't know

Anticipated Demand

Please provide your best estimate of the number of job openings in your company or organization for professionals with a Bachelor of Science in Materials Science and Engineering.

Positions might entail such job duties as failure analysis, materials characterization, microscopy, corrosion, simulation of materials behavior, material selection, metallurgical design of materials, selection of hybrid or composite materials, biomedical research, semiconductor fabrication, and other such materials-related positions.

<table>
<thead>
<tr>
<th>Number</th>
<th>Space for Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future Vicacres</td>
<td></td>
</tr>
<tr>
<td>1 Year Projection</td>
<td></td>
</tr>
<tr>
<td>5 Year Projection</td>
<td></td>
</tr>
<tr>
<td>10 Year Projection</td>
<td></td>
</tr>
<tr>
<td>Unable to estimate</td>
<td></td>
</tr>
</tbody>
</table>

Would you Hire?

Would you hire a B.S. graduate in Materials Science and Engineering?
- [ ] Yes
- [ ] No

Want to Know More?

We intend to prepare graduates with practical job skills for materials-related careers. Would you be interested in participating in any of the following? (Select all that apply)
- [ ] Student Research
- [ ] Internship
- [ ] Mentoring Program
- [ ] Access to classes or academic organizations
- [ ] Research Internships
- [ ] Providing on-chain projects for our capstone senior design course
- [ ] Sponsorship of the above
- [ ] Other

Thank you for participating in our survey. We value your comments and your time.

Materials Science & Engineering
Texas A&M University

If you have any comments or concerns about this survey, please contact:
Dr. Elaine H. H. Song
Undergraduate Program Development Committee
Department of Materials Science and Engineering
Dennis Hall, College Station, TX 77843-3126
Phone: 979-862-0471
Email: men@tamu.edu

The information you have provided in this survey will be used for research purposes. The Materials Science and Engineering Department at Texas A&M University is committed to the protection of your privacy. The data collected will not be shared with any third parties without your consent.

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APPENDIX C

Texas A&M Student Survey

Initiated November 2, 2015 – Summarized November 30, 2015

Department of Materials Science and Engineering (MSEN) SURVEY

<table>
<thead>
<tr>
<th>Basic Curriculum</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering 1st Year Sequence</td>
<td>27</td>
</tr>
<tr>
<td>University Core Curriculum</td>
<td>24</td>
</tr>
<tr>
<td>Core MSEN Courses</td>
<td>59</td>
</tr>
<tr>
<td>Designated (MSEN) Technical Electives</td>
<td>9</td>
</tr>
<tr>
<td>Free Electives</td>
<td>9</td>
</tr>
<tr>
<td>Total Credit Hours</td>
<td>128</td>
</tr>
</tbody>
</table>

Bachelor of Science in Materials Science and Engineering

The Dwight Look College of Engineering and the College of Science will propose a new undergraduate Bachelor of Science (BS) in Materials Science and Engineering to be launched in Fall 2017.

The MSEN major includes a series of core MSEN courses (59 crh) to provide a strong common foundation in the fundamental principles of materials science and engineering, a series of technical electives within MSEN (9 crh) to provide students depth in a particular emphasis area, and a series of free electives (9 crh) to allow students the flexibility to explore interdisciplinary studies, or to focus in greater depth on one or more MSEN areas.

Q1 Knowing what you know now, if a major in Materials Science and Engineering (MSEN) was an option when you selected your major:

○ A. I would have ranked a major in MSEN as my first choice
○ B. I would have considered a major in MSEN as one of my top 3 choices
○ C. I would have explored the MSEN major.
○ D. I would not have considered MSEN as a major.
○ E. I don’t know.

Currently, your major is:

<table>
<thead>
<tr>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. AERO</td>
<td>A. CVEN</td>
<td>A. MSEN</td>
<td>A. COLLEGE OF GEOSCIENCES</td>
</tr>
<tr>
<td>B. BAEN</td>
<td>B. CSECE</td>
<td>B. PETE</td>
<td>B. COLLEGE OF SCIENCE</td>
</tr>
<tr>
<td>C. BMED</td>
<td>C. CISS</td>
<td>C. COLLEGE OF AG &amp; LIFE SCI</td>
<td>C. OTHER</td>
</tr>
<tr>
<td>D. CHEN</td>
<td>D. ECEN</td>
<td>D. COLLEGE OF ARCH</td>
<td>D. GEORGE ENGINEERING</td>
</tr>
<tr>
<td>E. CHEM</td>
<td>E. ENTC</td>
<td>E. ESAYS SCHOOL OF BUSINESS</td>
<td>E. HAVE NOT CHOSEN A MAJOR</td>
</tr>
</tbody>
</table>

Q6 How interested are you in materials science and engineering?
○ A. Very Interested
○ B. Interested
○ C. Neutral
○ D. Not Very Interested
○ E. Not Interested

Q7 What year are you in your studies?
○ A. Freshman
○ B. Sophomore
○ C. Junior
○ D. Senior
○ E. Senior (more than 90 hrs)

Q8 What is the likelihood you will change your major to materials science and engineering?
○ A. Highly likely
○ B. Likely
○ C. Neutral
○ D. Not likely
○ E. Not at all likely

Q9 Do you like the idea of Texas A&M University offering a new BS in materials science and engineering?
○ A. Yes
○ B. Neutral
○ C. No

Thanks Ags! We Care what you think!

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APPENDIX D
ACADEMICS

Advising
The Bachelor of Science program will be managed by the Department of Materials Science and Engineering in the Dwight Look College of Engineering and College of Science at Texas A&M University. In addition to the formal staff Academic Undergraduate Advisor, each student will be assigned (starting in the first semester of the sophomore year) a faculty mentor who will provide advice on the optimal, individualized degree program, to meet each student’s career goals and objectives. Specifically, the faculty mentor will advise on matters related to possible emphasis areas as well as other curriculum components that can contribute to the enrichment of the educational experience of the students. Pairing of students and advisors will be conducted to maximize the overlap in UG self-identified goals, with technical areas of expertise of faculty advisors. This process will occur on the basis of personal statements of interest that UG students generate during their sophomore year in “MSEN 201: Fundamentals of Materials Science” – a survey course designed to expose students to a wide breadth of the field of materials science and engineering. Advising during the sophomore and junior years will be focused on possible emphasis areas, while advising during the senior year will be centered on maximizing students’ post-graduation ambitions.

An Advising Committee within the department will be composed of the Director of the Undergraduate Program (faculty member), the Academic Undergraduate Advisor (staff member) and three (3) faculty appointed by the Department Head.

Admission
Engineering students may apply by three avenues:

1. Admission by Entry-to-a-Major Process. Entry to a Major for students who were admitted to General Engineering in the Dwight Look College of Engineering or the Engineering Academies.

2. Admission by Change of Curriculum. Change of Curriculum for students already attending Texas A&M University in majors other than the materials science and engineering Undergraduate Program.

3. Admission by Transfer. Transfer from colleges and universities outside of Texas A&M University.

The Department of Materials Sciences and Engineering will follow the guidelines and policies set out by the Look College official academic procedures for admission and transfer.
APPENDIX E

College / University Procedures

The Dwight Look College of Engineering has a dynamic unit: Engineering Academic Student Affairs (EASA). This unit provides consistent and dynamic information for all undergraduate and graduate students related to entry-to-a-major and transfer or admission requirements. Access to academic advisors and all admittance procedures can be located online via: http://engineering.tamu.edu/academics/advisors-procedures/advisors.

MSEN will follow and look to EASA to guide any admission and transfer issues related to undergraduates. The following are a few of the details regarding entry-to-a-major, transfer eligibility and automatic admissions.

Entry-To-A-Major
http://engineering.tamu.edu/academics/advisors-procedures/entry-to-a-major

The entry-to-a-major (ETAM) process is designed for students to take ownership of their future to identify at least three majors that are a good match for their career goals and academic performance. The general engineering advisors, as well as departmental advisors, are available for questions and advice. Students are encouraged to leverage additional resources, including the career center and departmental faculty to get career advice.

The ETAM process utilizes a priority method that is designed to place students in the highest rank major based upon capacity and student performance. Students will no longer have the option to accept or deny a decision. For the case that a student determines that the highest rank major is not a good match, students have the option to pursue a change of curriculum to a different major within the Look College or Texas A&M University.

Students must apply to three majors with the option to select up to five majors. Majors must be ranked in order of preference. Students are strongly encouraged to apply during the spring/summer cycle.

Fall 2017 dates for admission will be posted in the near future. Students who are not in a major after the fall 2016 cycle will work closely with a general engineering advisor to enter into a major.

All deadlines are by 11:59 p.m. Central Time on the date specified.

Automatic Admits

• The entry-to-a-major process includes automatic admission to the first choice major for students with a 3.5 cumulative GPA after the first two semesters for the spring/summer application process only.

• Students are required to have completed two engineering courses, two science courses, and two math courses (one of which must be at least Math 151), all with a grade of C or higher. Exceptions will be made as needed for students who enter with credit for math and science courses.
Changing Majors
http://engineering.tamu.edu/academics/advisors-procedures/changing-majors

Eligibility Requirements
• Student eligibility will be based upon at least two semesters of course work at Texas A&M University.
• Students are eligible based upon courses completed by the end of the semester in which the application is submitted (e.g., for students who submit an application during the spring semester, the eligibility is based upon the courses completed at the end of the spring semester).
• Students must be in good academic standing (e.g., requires a cumulative GPA of at least 2.0) and not be on academic probation at the end of the semester during which the application is submitted (e.g., requires the term GPA of at least 2.0).

Required Coursework
General engineering students are required to complete at least the following courses at Texas A&M University with a minimum grade of C or higher:

• Engineering: Two engineering courses from the following list – ENGR 111, ENGR 112, CSCE 111, CSCE 121, CSCE 221; for students who start in ENGR 289, the requirement is one engineering course.

• Science: Two science courses from the following list – PHYS 218*, PHYS 208*, PHYS 222, CHEM 157/117, CHEM 101/111*, CHEM 102/112*. In addition to the courses listed with asterisks, students with a preference in computer science may also choose from BIOL 101, 107, 111, 112, 113; GEOL 101, 106; GEOG 203/213; ATMO 201/202; RENR 205/215.

• Math: Two math courses from the following list – MATH 151, 152, 251, 253, 304, 308; CSCE 222 (Discrete Math); for students who start in ENGR 289 or MATH 150, the requirement is one math course from the list.

Probation and Block Policies
http://engineering.tamu.edu/academics/advisors-procedures/probation

Appeals
http://engineering.tamu.edu/academics/advisors-procedures/appeals

Further issues regarding admission, transfer, entry-to-a-major and academic progress will utilize the EASA resources outlined in the Look College academic policies: http://engineering.tamu.edu/academics.
APPENDIX F

Course Descriptions

Credits 3. 3 Lecture Hours
Pre-reqs: CHEM 101 or 107; PHYS 218
Fundamental principles of materials science and engineering, and their application towards complex engineering challenges; relationship between materials structure and structural and functional properties of engineered materials; property-performance relationships; principle classes of materials, as illustrated through key materials advances; current directions in the field.

MSEN 210, Thermodynamics of Materials.
Reference Page 55.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 210\textsuperscript{cr}, MATH 152\textsuperscript{cr}
Introduction to basic concepts and fundamental laws of thermodynamics; processes and thermodynamic engines; phase equilibria and phase diagrams of simple substances; chemical reactions of condensed phases; computational software for thermodynamic and phase diagram calculations.

MSEN 220, Physics and Chemistry of Inorganic Materials. Reference Page 59. (to be cross-listed in the future as CHEM/MSEN 220)
Credits 3. 3 Lecture Hours
Pre-reqs: CHEM 102\textsuperscript{cr}, PHYS 208\textsuperscript{cr}
Structure, properties, and function of materials developed from an atomistic and molecular perspective emphasizing quantum chemical descriptions; elements of solid-state chemistry and physics including bonding, crystal structure and symmetry, origin of electronic band structure; synthesis and characterization tools in materials chemistry; role of finite size effects.

MATH 307, Analytical Methods for Materials Scientists and Engineers. Syllabus Not Provided
Credits 3. 3 Lecture Hours
Pre-reqs: MATH 251
Introduction to analytical methods for developing models and solutions to problems pertinent to the materials science and engineering discipline; crystal symmetries and tensor properties; material response to external fields; constitutive equations and energy minimization; reaction and transformation rates; viscoelastic properties.

MSEN 240, Kinetics of Materials
Reference Page 63.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 210
Application of physical principles that drive the evolution of materials as they approach thermodynamic equilibrium states; topics include: Gibbs free energy, driving forces, point defects, diffusion in solids, interface and grain boundary motion, nucleation, growth, transformation diagrams, precipitation, phase separation, ordering, solidification.

MSEN 250, Soft Matter
Reference Page 67.
Credits 3. 3 Lecture Hours
Pre-reqs: PHYS 208, CHEM 102, CHEM 112
Structure, properties, and function of various classes of soft matter including colloids, polymers, amphiphilic, liquid crystals, and biomacromolecules; basic concepts of viscoelasticity, glass transition, liquid-liquid and liquid-solid transitions and gelation; forces acting between mesoscopic objects; supramolecular self-assembly in soft condensed matter.

MSEN 281, Materials Science and Engineering Seminar
Reference Page 71.
Credits 1. 1 Lecture Hours
Pre-reqs: MSEN 201
Seminar series presenting technical advances in the field of materials science and engineering and applications of this field towards solving engineering challenges; presentations from visiting industry and academic speakers, as well as faculty; introduction to current research themes and focal points in industry.

MSEN 301, Unified Materials Lab I
Reference Page 75
Writing intensive course
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 240\textsuperscript{cr}, MSEN 310\textsuperscript{cr}
Unified materials lab integrating materials synthesis, structural characterization, and property evaluation; theory and practice of experimental and simulation techniques; emphasis on relationship between processing parameters and resulting materials structure.

MSEN 302, Unified Materials Lab II
Reference Page 79.
writing intensive course
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 301
Unified materials lab integrating materials synthesis, structural characterization, and property evaluation; theory and practice of experimental and simulation techniques; emphasis on relationship between materials structure and resulting materials physical properties.

MSEN 310, Structure of Materials
Reference Page 83.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 201
Materials structure over many orders of scale; structure of non-crystalline materials; symmetry, unit cell, and the atomic structure of crystalline materials; liquid crystals; structural defects in ordered solids; microstructures and hierarchical structures.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 310, or approval of instructor
Survey of deformation and failure mechanisms in different materials, including metals, ceramics, polymers, and composites; effect of atomistic structure, defects and microstructure on deformation and failure; deformation and failure mechanism maps and effects of temperature and deformation rate.

Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 230
The purpose of this course is to introduce students to the use of computing platforms to address scientific/engineering problems related to materials science and engineering. Emphasis will be placed on the use of computer programming to: analyze data, implement mathematical models of materials behavior, the use of numerical methods to solve materials-related problems.

MSEN 340, Case Studies in Materials
Reference Page 95.
Credits 2. 2 Lecture Hours
Pre-reqs: MSEN 320
Case studies illustrating materials failure and consequences thereof; materials selection process in the face of uncertainty; industry standards and regulatory frameworks; design tradeoffs and cost analysis; ethical and business implications of materials failure.

Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 210, MSEN 330
Studio course introducing methods to simulate materials behavior across multiple scales; topics include: electronic structure calculations, classical molecular dynamics, computational thermodynamics and kinetics of materials, microstructure evolution simulation, continuum models of materials behavior.

MSEN 400, Design and Analysis of Materials Experiments. Reference Page 103.
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 220, MSEN 302, MSEN 320
Systematic design of experimental investigations; student teams identify topics in consultation with the instructor and develop experiment designs including establishing the need, associated requirements and objective; conduct experiments; characterize materials; analyze and interpret results; documenting the procedures, analysis, results, and conclusions; present written and oral reports.

MSEN 401, Materials Research and Design I
Reference Page 107.
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 281, MSEN 340, MSEN 400
The research and design process; need definition, functional analysis, performance requirements, evaluation criteria, conceptual design evaluation; introduction to systems engineering; parametric and risk analysis, failure analysis, material selection, and manufacturability; cost and life cycle issues, project management; topics will come from sponsored research or an industry-sponsored design project.

MSEN 402, Materials Research and Design II
Reference Page 111.
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 401
Continuation of MSEN 401; development of innovative solutions to research or industry-provided design challenges; structured framework and methodology for design activities; innovation, computational materials science, synthesis/processing, and analysis/characterization of material components; project definition, management, customer interaction and effective team participation; presentations and design reviews.

MSEN 410, Materials Processing
Reference Page 115.
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: Junior or Senior classification, MSEN 201; or approval of instructor.
The course will provide an introduction to synthesis, properties and processing of technologically important inorganic materials (metals and ceramics). Topics covered will include thermodynamics and kinetics of different materials processing methods, casting, deformation processing, heat treatments, powder processing and sintering, coating and thin films processing, etc.

MSEN 415, Defects in Solids
Reference Page 119.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 310
Overview of point, line, and surface defects in solids; relates defect properties to diffusion, deformation, phase transformations; focuses on atomic defects in crystals, with additional examples from liquid crystals, superconductors, and ferromagnets; incorporates atomistic modeling to examine defect structure.

MSEN 420, Polymer Science
Reference Page 123.
Credits 3. 3 Lecture Hours
Pre-reqs: PHYS 208, CHEM 102, CHEM 112; or approval of instructor.
Types of polymerization and molecular characteristics of polymer chains; single chain statistics and rubber elasticity; phase transitions, glass transition, viscoelasticity and time-temperature superposition; polymer structure at the molecular, microscopic and macroscopic levels; polymer thermosets, thermoplastics, elastomers, fibers, and advanced nanoparticle-filled composites.
MSEN 426, Polymer Laboratories
Reference Page 127.
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 250; or approval of instructor
Laboratory class to prepare students who are interested in polymer research with necessary experimental and analytical skills to conduct and analyze experimental work.

MSEN 430, Nanomaterials Science
Reference Page 131.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 310, Junior or Senior classification; or approval of instructor
Nanotechnology and nanomaterials; types, fabrication, characterization methods, and applications; their current roles in technology, and the likely future impact of such systems on industry targeting.

MSEN 440, Materials Electrochemistry and Corrosion
Reference Page 135.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 220; or approval of instructor
Survey of thermodynamic and kinetic fundamentals of electrochemistry; multiscale materials corrosion mechanisms; details of interfacial aqueous electrochemical mechanisms and the environmental effects when materials are exposed to different conditions.

MSEN 444, Corrosion and Electrochemistry Lab
Reference Page 139.
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 440
Laboratory practice and principles for corrosion and electrochemistry methods; students will design, carry out, and analyze a series of labs illustrating the most important techniques in the field; course builds to an open-ended corrosion engineering problem resulting in preparation of a technical report for a hypothetical client.

MSEN 446, Corrosion Prevention and Control Methods
Reference Page 145.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 440, MSEN 444, MEEN 360
Cathodic protection and coatings as corrosion prevention and control methods for different applications; functional engineering approach to controlling and preventing aqueous corrosion based on engineering methodologies; impressed current, galvanic anodes, organic, inorganic and hybrid coatings; case of studies in the oil and gas, energy, automotive and different industries are included to illustrate the application of each method.

MSEN 458, Fundamentals of Ceramics
Reference Page 147.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 310; or approval of instructor
Structure-property relationships of ceramics and ceramic composites; atomic bonding in ceramics; crystalline and glassy structures; phase equilibria and ceramic reactions; mechanical, electrical, thermal, dielectric, magnetic, and optical properties; and ceramic processing; different properties of ceramics will be related to their underlying structure.

MSEN 460, Properties of Functional Materials
Reference Page 151.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 220, MSEN 310; or approval of instructor
Origins of functional materials properties from their electronic and molecular structure; electron theory in solids; electronic transport and dielectric behavior; optical and magnetic properties; current applications of functional materials.

MSEN 462, Advanced Materials Characterization
Reference Page 155.
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 220, MSEN 250, MSEN 310; or approval of instructor
Principles and techniques used in characterization of different materials, including metals, ceramics, polymers, composites, and semiconductor systems; microstructural, chemical/compositional, and surface analysis methods; interpretation and analysis of the characterization results.

MSEN 472, Atomistic Simulation of Materials
Reference Page 159.
Credits 3. 3 Lecture Hours
Pre-reqs: MSEN 370; or approval of instructor
Modern methods of computational modeling and simulation of materials properties and phenomena at the atomistic scale; quantum, classical, and statistical mechanical methods, including semi-empirical atomic and molecular-scale simulations, and other modeling techniques using macroscopic input.

MSEN 474, Materials Modeling of Phase Transformation and Microstructural Evolution.
Reference Page 163.
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 370; or approval of instructor
Computer modeling and simulation of microstructural evolution during various phase transformation processes in solid materials, including spinodal decomposition, ordering, martensitic transformation, ferroelectric and ferromagnetic domain evolution, nucleation, growth, solidification.

MSEN 476, Multi-Scale Computational Materials Science.
Reference Page 167.
Credits 3. 2 Lecture Hours, 3 Lab Hours
Pre-reqs: MSEN 370; or approval of instructor
This is a problem-based advanced course illustrating elements of the challenges associated with multi-scale simulations in materials science. As an example, the course will examine the multi-scale modeling of elastic response of a multi-phase microstructure. Elements of uncertainty quantification and propagation will be central to the course.

Request for New B.S. Degree Program
Page 47
Communications intensive course
Credits 1. 1 Lecture Hours
Pre-reqs: MSEN 401 or registration therein Effective communication of technical topics in materials science and engineering to technical and non-technical audiences; emphasis on oral and visual presentations.

MSEN 484, Internship
Reference Page 175.
Credits 0-4.
Pre-reqs: Junior or Senior classification, approval of instructor
Practical experience working in a professional materials science and engineering setting offered on an individual basis.

MSEN 485, Directed Studies
Reference Page 179.
Credits 0-4.
Pre-reqs: Junior or Senior classification, approval of instructor
Directed study of selected problems in the area of materials science and engineering not covered in other courses. May be taken four times for credit.

MSEN 491, Research
Reference Page 183.
Credits 0-4.
Pre-reqs: Approval of instructor
Research conducted under the direction of faculty members in materials science and engineering. May be taken four times for credit.
APPENDIX G

COURSE SYLLABI
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MSEN 201, Fundamentals of Materials Science and Engineering
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Ibrahim Karaman, Reed McDonald Bldg. 235, ikaraman@tamu.edu, 979.862.3923

Course (catalog) description: Fundamental principles of materials science and engineering, and their application towards complex engineering challenges; relationship between materials structure and structural and functional properties of engineered materials; property-performance relationships; principle classes of materials, as illustrated through key materials advances; current directions in the field.

Course Prerequisites: CHEM 101 or 107; PHYS 218

Learning Outcomes: At the end of this course, students should be able to:
1. Relate the role of materials science and engineering in advancing fundamental engineering challenges,
2. Illustrate the relationship between materials synthesis, resulting structure, properties, and performance with examples from modern engineering materials.
3. Describe the differences in macroscopic physical properties for different classes of materials (metals, polymers, ceramics, semiconductors, composites). Explain the physical and chemical origin of these differences.
4. Describe microstructure and atomic structure in materials, and defects in that structure; relate structural properties to that structure.
5. Describe bonding and electronic structure in materials; relate electronic structure to functional materials properties.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Pt 1: Structural Materials and Properties
Week 1 Mechanical Properties of Engineering Materials
Week 2 Cryogenic Metals: Structure of Metals
Week 3 Ultrahard Tool Coatings: Structure of Ceramics
Week 4 Synthetic Rubber: Structure of Polymers
Week 5 Lightweight Aerospace Materials: Structure of Composites
Week 6 Efficient Vehicles: Strengthening Mechanisms in Alloys
Week 7 Design of Steels: Phase Diagrams of Materials
Week 8 Turbine Superalloys: Creep, Fatigue, Fracture

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Pt 2: Functional Materials and Properties
Week 9 Fuel Cells: Diffusion in solids
Week 10 Stainless Steel: Corrosion in solids
Week 11 The Integrated Circuit: Electronic Properties
Week 12 Thermal Barrier Materials and Heat Spreaders: Thermal Properties
Week 13 The Hard Disk and the Wind Turbine: Magnetic Properties
Week 14 Photovoltaics and LEDs: Optical Properties

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Understanding of fundamental concepts of Materials Science and Engineering will be evaluated through two in-class exams, and through a final group term paper relating design and engineering of material properties for specific technological applications.

Student understanding will be assessed throughout class in the form of quizzes, HWs, and in-class group activities, to ascertain that students are meeting desired learning outcomes.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Exam #1 (30 %) {Week 9}
Exam #2 (30 %) {Week 13}
Final Group Term Paper (20 %) {Week 14}
Quizzes (5 %)
In-Class Participation (5 %)
Homework (10 %)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.
Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university -excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsorauth/index
2. Death or major illness in a student’s immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student’s presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a healthcare professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student’s physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

Academic Integrity:
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu .
**Americans with Disabilities Act (ADA) Policy Statement:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit [http://disability.tamu.edu](http://disability.tamu.edu).
MSEN 210, Thermodynamics of Materials
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Raymundo Arroyave, Reed McDonald Bldg. 218, rarroyave@tamu.edu, 979-777-7116

Course (catalog) description: Introduction to basic concepts and fundamental laws of thermodynamics; processes and thermodynamic engines; phase equilibria and phase diagrams of simple substances; chemical reactions of condensed phases; computational software for thermodynamic and phase diagram calculations.

Course Prerequisites: MSEN 201 or registration therein, MATH 152 or registration therein.

Learning Outcomes: At the end of this course, students should be able to:
1. Understand and explain the fundamental laws of thermodynamics
2. Use thermodynamic principles to interpret phase equilibria, and chemical reactions
3. Apply the concept of equilibrium and free energy minimization to construct phase diagrams
4. Calculate phase diagram and thermodynamic properties using computational thermodynamics software.


Supplementary References:
Thermodynamics in Materials Science, Robert DeHoff, CRC Press (2nd Edition)

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 Introduction and Definition of Terms
Week 2 The First Law of Thermodynamics
Week 3 The Second Law of Thermodynamics
Week 4 Statistical Interpretation of Thermodynamics
Week 5 Auxiliary Functions
Week 6 Heat Capacity, Enthalpy, and Entropy
Week 7 The Third Law of Thermodynamics
Week 8 Phase Equilibrium in a One-Component System
Week 9 Introduction to Computational Thermodynamics Software
Week 10 The Behavior of Solutions
Week 11 Gibbs Free Energy, Composition and Phase Diagrams of Binary Systems
Week 12 Reactions involving Pure Condensed Phases and a Gaseous Phase
Week 13 Reaction Equilibria in Systems Containing Components in Condensed Solution
Week 14 Phase Diagrams for Binary Systems in Pressure-Temperature-Composition Space

Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Proper understanding and application of thermodynamics will be evaluated through written exams, homework, quizzes, projects, and in-class participations. In addition, students will be guided to use computational software Thermo-Calc for thermodynamic and phase diagram calculations in the projects and homework. These activities will help assess student learning and understanding of the knowledge taught in the course.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Midterm Exam (30%) {Week 7}
Comprehensive Final (35%) {end of semester}
Homework (10%)
Quizzes (10%)
Project (10%)
In-Class Participation (5%)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.
The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a healthcare professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonors.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
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MSEN220, Physics and Chemistry of Inorganic Materials
(To be cross-listed as CHEM/MSEN 220 in future)
3 Credits

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information: Dr. Sarbajit Banerjee/Dr. James Batteas
Chemistry 222, banerjee@chem.tamu.edu, 979-862-3102
Chemistry 2119C, batteas@chem.tamu.edu, (979) 458-2965

Course (catalog) description: Structure, properties, and function of materials developed from an atomistic and molecular perspective emphasizing quantum chemical descriptions; elements of solid-state chemistry and physics including bonding, crystal structure and symmetry, origin of electronic band structure; synthesis and characterization tools in materials chemistry; role of finite size effects

Course Prerequisites: PHY 208 (co-requisite) OR CHEM 102 (co-requisite)

Learning Outcomes: At the end of this course, students should be able to:
1. Have an understanding of common crystal structures and their representations
2. Recognize how symmetry and chemical bonding influence structures adopted by inorganic materials
3. Describe the role of valence electron structure in the resulting bonding present in solids.
4. Relate the origin of electronic band structure in materials.
5. Possess a basic understanding of analytical methods that can be applied to study materials and be able to devise testing plans
6. Appreciate the role of finite size in influencing the properties of materials


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 Common structure types in solid-state chemistry
Week 2 Visualization and representation of crystal structures
Week 3 Rationalizing structure types
Week 4 Crystal field theory and lattice energetics
Week 5 Symmetry operations and point groups
Week 6 Space groups and Bravais lattices
Week 7 Elementary crystallography
Week 8 Chemical bonding and band structure: from bonds to bands
Week 9 Simple models of electronic structure
Week 10  Optical and electronic properties
Week 11  Quantum size effects
Week 12  Synthetic strategies in materials chemistry
Week 13  An introduction to defect chemistry
Week 14  Extended defects

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Understanding of the content will be assessed through graded problem sets, three in-class exams, a final exam, and a literature assignment.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Problem sets: 20% {Weekly}
Midterm exams: 45% {Weeks 4 & 8}
Literature assignment: 10%
Final exam: 25%

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.
The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
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MSEN 240, Kinetics of Materials  
Credits 3. 3 Lecture Hours  

Term: Fall 2017  

Meeting times and locations: TBD  

Instructor Information:  
Dr. Raymundo Arroyave, Reed McDonald Bldg. 218, rarroyave@tamu.edu. 979-777-7116  

Course (catalog) description: Application of physical principles that drive the evolution of materials as they approach thermodynamic equilibrium states; topics include: Gibbs free energy, driving forces, point defects, diffusion in solids, interface and grain boundary motion, nucleation, growth, transformation diagrams, precipitation, phase separation, ordering, solidification.  

Course Prerequisites: MSEN 210  

Learning Outcomes: At the end of this course, students should be able to:  
1. Quantify driving forces for phase transformations by comparing Gibbs energies of phases taking part in transformation.  
2. Apply physical principles to the quantification of rates of evolution in materials systems.  
3. Use understanding of different kinds of solid-solid phase transformations (precipitation, segregation, ordering, martensitic transformation) and their influence on microstructure evolution in materials.  
4. Interpret materials microstructures in terms of possible transformation paths  
5. Interpret transformation diagrams and to use them to design materials processing parameters  
6. Understand how cooling rates and thermal gradients affect microstructures observed during solidification processes.  

Textbook: Phase Transformations in Metals and Alloys, Porter and Easterling, Second Edition,  

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.  

Course Outline:  
Week 1 Thermodynamics in Phase Transformations  
Week 2 Driving Forces for Materials Evolution  
Week 3 Phenomenology of Diffusion Equation  
Week 4 Strategies for the Solution to the Diffusion Equation: Steady State  
Week 5 Strategies for the Solution to the Diffusion Equation: Non-steady State  
Week 6 Atomistic Basis for Diffusion  
Week 7 Diffusion in liquids, polymers and amorphous materials
Week 8     Interface and Grain Boundary Motion
Week 9     Nucleation and Growth
Week 10    Precipitation
Week 11    Phase Separation
Week 12    Ordering
Week 13    Martensitic Transformations
Week 14    Relationships between Phase Transformations and Microstructures

**Course Policies and Procedures:**

*Changes in schedule:*
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

*Assessment and Evaluation:*
The course will be evaluated through quizzes, homework, exams and a final paper.

**Grading Scale (Standard Letter Scale):**
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

**Grading Policies:**
Homework: 30% *{Weekly}*
Exam 1: 20% *{Week 4}*
Exam 2: 20% *{Week 8}*
Quizzes: 10%
Final paper: 20% *{Week 14}*

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

**Late Work Policy:**
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

**Attendance:**
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07). Please come on time. Silence cell phones and other electronic distractions.

**Make-up Policy:**
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.
The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details, http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   iii. Injury or Illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   iv. Injury or Illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      c) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      d) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
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MSEN 250, Soft Matter
Credits 3, 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Svetlana Suchishvili, Reed McDonald Bldg. 221, svetlana@tamu.edu, 979-458-9840

Course (catalog) description: Structure, properties, and function of various classes of soft matter including colloids, polymers, amphiphils, liquid crystals, and biomacromolecules; basic concepts of viscoelasticity, glass transition, liquid-liquid and liquid-solid transitions and gelation; surface thermodynamics and surface tension; wetting and adhesion; forces acting between mesoscopic objects; supramolecular self-assembly in soft condensed matter.

Course Prerequisites: PHYS 208, CHEM 102, CHEM 112

Learning Outcomes: At the end of this course, students should be able to:

1. Identify main distinctive features of soft matter, including wide spectra of length scales and relaxation times;
2. Recognize how molecular structure and organization determine the properties of soft materials;
3. Explain how molecular entanglements affect materials' viscoelastic properties;
4. Identify and quantify main forces acting between mesoscopic objects: Van der Waals and electrostatic interactions.
5. Appreciate the role of self-assembly of biological macromolecules;
6. Describe physical laws that define wetting and adhesion;
7. Give a quantitative description of cooperativity as a driving force in self-assembly.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 Introduction to organic molecules, functional groups
Week 2-3 Chemical structures and bonding in organic molecules, surfactants, and biological molecules
Week 4 Dynamics, phase transitions and viscoelasticity in soft materials
Week 5 Polymer chain conformation and configuration polymer solutions and melts
Week 6 Glass transition; rubbers and gels
Week 7 Surfaces, interfaces and colloids: surface thermodynamics
Week 8 Surface tension, van der Waals forces
Week 9 Wetting and adhesion
Week 10  Electrostatic double layer, colloidal crystals
Week 11  Colloidal coagulation and stabilization, colloidal gels
Week 12  Micelles and liquid crystals
Week 13  Biological soft matter: electrostatics, hydration
Week 14  Biological soft matter: cooperativity and self-assembly

Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Progress towards achieving learning outcomes will be evaluated through graded problem sets, midterm and final exam, and a literature assignment.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Problem sets: 20% (Weekly)
Midterm exams: 30% (Weeks 4 & 8)
Literature assignment: 10%
Final exam: 30% (End of semester)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.
The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at [https://studentactivities.tamu.edu/app/sponsauth/index](https://studentactivities.tamu.edu/app/sponsauth/index)
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at [http://attendance.tamu.edu](http://attendance.tamu.edu) or
      b) Confirmation of visit to a health care professional affirming date and time of visit,
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: [http://aggiehonor.tamu.edu](http://aggiehonor.tamu.edu).

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MSEN 281, Materials Science and Engineering Seminar
Credits: 1. 1 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Li Liu, Reed McDonald Bldg. 227, li.liu@tamu.edu, 979-458-1090

Course (catalog) description: Seminar series presenting technical advances in the field of materials science and engineering and applications of this field towards solving engineering challenges; presentations from visiting industry and academic speakers, as well as faculty; introduction to current research themes and focal points in industry.

Course Prerequisites: MSEN 201.

Learning Outcomes: At the end of this course, students should be able to:
1. Describe several recent technical breakthroughs, and the technologies they enable,
2. Describe fundamental and applied materials research and development,
3. Describe materials-focused activities pursued by industrial materials engineers,
4. Identify areas of personal interest in the field of materials science and engineering.

Textbook: None.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1-14 Technical Seminars (speakers TBD)
Week 5 First Reflection due
Week 10 Second Reflection due
Week 14 Final Reflection (personal interest statement) due

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Understanding of recent technological breakthroughs will be evaluated by a series of three reflective pieces. The first two reflective pieces focus on relating the motivation, context, and results of a recent breakthrough. The final piece focuses on identifying areas of interest to a student — this final piece will be utilized in pairing UG students with initial faculty advisors.
**Grading Scale (Standard Letter Scale):**
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

**Grading Policies:**
First Reflection (30%)
Second Reflection (30%)
Final Reflection (20%)
Final Exam (20%)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

**Late Work Policy:**
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

**Attendance:**
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07). Please come on time. Silence cell phones and other electronic distractions.

**Make-up Policy:**
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

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2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student’s physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

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MSEN 301, Unified Materials Lab I
writing intensive course
Credits: 3. 2 Lecture Hours/ 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Terry Creasy, Reed McDonald Bldg. 217, lcreasy@tamu.edu, 979-458-0118

Course (catalog) description: Unified materials lab integrating materials synthesis, structural characterization, and property evaluation; theory and practice of experimental and simulation techniques; emphasis on relationship between processing parameters and resulting materials structure.

Course Prerequisites: MSEN 240 or registration therein, MSEN 310 or registration therein.

Learning Outcomes: At the end of this course, students should be able to:
1. Demonstrate fundamental synthesis techniques of different classes of materials,
2. Demonstrate key materials characterization approaches,
3. Relate the strengths and weaknesses of experimental and simulation techniques,
4. Explain the theory of different synthesis, characterization, and simulation techniques,
5. Analyze and report experimental and simulation data, including basic statistical analysis and uncertainty quantification,
6. Effectively communicate technical results in formal lab report form.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1, 2 Evolution of Metal Microstructures:
   Heat Treatment, Optical Microscopy, Grain Coarsening Prediction
Week 3, 4 Polymer Coatings
   Coating process & film morphology, Scanning Electron Microscopy
Week 5, 6 Composite Layup
   Anisotropy & Failure in Composites, Optical & Scanning Electron Microscopy
Week 7, 8 Sintering and Diffusion in Solid State Ceramics
   Sintering Process, X-Ray Diffraction, Diffusion Simulation
Week 9, 10 Thin Metal films
   Deposition of thin films, X-Ray Diffraction/Atomic Force Microscopy
Week 11, 12 Hydrogels
   Gelation process, FTIR Spectroscopy
Week 13, 14 Electrochemical Deposition
   Solution-based Deposition of Coatings, Combined Microscopy/Diffraction Techniques
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Analysis and interpretation of technical data will be assessed through technical content of lab reports. Emphasis on understanding of underlying theory through required description of ‘methods’; emphasis on data analysis through presentation of ‘results’ in data and figure form; emphasis on interpretation through ‘discussion’ of results. This course is a formal w course. Thus, 1 crh (33.3 % of grade) will be based on form, content, style and grammar of written lab reports. Submission of lab reports will follow an iterative process to impart technical editing and revision skills.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Analysis and interpretation of technical data (66.6 %)
Form, content, style and grammar of written lab reports (33.3 %)

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
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   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
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Other absences may be excused at the discretion of the instructor with prior notification and proper documentation

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

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MSEN 302, Unified Materials Lab II
writing intensive course
Credits 3. 2 Lecture Hours/3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Terry Creasy, Reed McDonald Bldg. 217, teresy@tamu.edu, 979-458-0118

Course (catalog) description: Unified materials lab integrating materials synthesis, structural characterization, and property evaluation; theory and practice of experimental and simulation techniques; emphasis on relationship between materials structure and resulting materials physical properties.

Course Prerequisites: MSEN 301.

Learning Outcomes: At the end of this course, students should be able to:
1. Demonstrate fundamental synthesis techniques of different classes of materials,
2. Demonstrate key materials property characterization approaches,
3. Relate the strengths and weaknesses of experimental and simulation techniques,
4. Explain the theory of different synthesis, characterization, and simulation techniques,
5. Analyze and report experimental and simulation data, including basic statistical analysis and uncertainty quantification,
6. Effectively communicate technical results in formal lab report form.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:

Week 1, 2 Hardening of Metals
   Heat Treatment, Plastic Deformation, Strengthening Mechanisms
Week 3, 4 Viscoelastic solids
   Viscoelastic and viscoplastic properties
Week 5, 6 Fracture and failure of composite materials
   Anisotropy & Failure in Composites
Week 7, 8 Dielectric Oxides
   Processing of capacitors, capacitor breakdown
Week 9, 10 Corrosion of Metals
   Electrochemical testing
Week 11, 12 Thermal Insulators and Conductors
   Characterization of thermal transport
Week 13, 14 Magnetic thin films
   Electronic and magnetic properties of thin films
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Analysis and interpretation of technical data will be assessed through technical content of lab reports. Emphasis on understanding of underlying theory through required description of ‘methods’; emphasis on data analysis through presentation of ‘results’ in data and figure form; emphasis on interpretation through ‘discussion’ of results. This course is a formal course. Thus, 1 crh (33.3 % of grade) will be based on form, content, style and grammar of written lab reports. Submission of lab reports will follow an iterative process to impart technical editing and revision skills.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Analysis and interpretation of technical data (66.6 %)
Form, content, style and grammar of written lab reports (33.3 %)

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university -excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index.
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.f)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
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MSEN 310, Structure of Materials
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Patrick Shamberger, Reed McDonald Bldg. 229, patrick.shamberger@tamu.edu, 979-458-1086

Course (catalog) description: Materials structure over many orders of scale; structure of non-crystalline materials; symmetry, unit cell, and the atomic structure of crystalline materials; liquid crystals; structural defects in ordered solids; microstructures and hierarchical structures.

Course Prerequisites: MSEN 201, MSEN 222, AERO 413, BMEN 343, CHEN 313, CVEN 306, ENTC 206, or NUEN 265, or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
1. Describe atomic structure in non-crystalline materials.
2. Use basic structural concepts to describe the crystal structure, including: the Bravais lattice; the unit cell; the crystal structure; planes and directions in a crystal.
3. Identify symmetry and symmetry operations. Symmetry operations and point groups.
4. Describe the structure of liquid crystals and differentiate these materials from other crystalline materials.
5. Identify and describe structural defects in ordered solids.
6. Describe structural hierarchy in materials from atomic length-scales through macroscopic length-scales.
7. Describe techniques used to investigate materials structure at many different length scales.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 Introduction to Structural Terms
Week 2-3 Noncrystalline Materials
Week 4-8 Crystalline State
Week 9 Liquid Crystals
Week 10-12 Defects
Week 13-14 Microstructures

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

**Assessment and Evaluation:**
Understanding of structure-property relationships will be evaluated through both conceptual questions and numerical problems in which relevant physical quantities will be calculated from fundamental relationships. Homework assignments and quizzes will play important roles in gaining a mastery of the course material.

**Grading Scale (Standard Letter Scale):**
A = 90-100  
B = 80-89.99  
C = 70-79.99  
D = 60-69.99  
F = <60

**Grading Policies:**
Midterm (40 %) *{Week 8}*  
Comprehensive Final (50 %) *{End of semester}*  
Homework (10%)  

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

**Late Work Policy:**
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

**Attendance:**
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07). Please come on time. Silence cell phones and other electronic distractions.

**Make-up Policy:**
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university -excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at [https://studentactivities.tamu.edu/app/sponsauth/index](https://studentactivities.tamu.edu/app/sponsauth/index)
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.

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4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
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MSEN 320, Deformation and Failure Mechanisms in Engineering Materials
Credits 3. 3 Lecture Hours

Term: Fall 2017
Meeting times and locations: TBD

Instructor Information:
Dr. Alan Needleman, Reed McDonald Bldg. 228, needle@tamu.edu, 979.862.2021

Course (catalog) description: Survey of deformation and failure mechanisms in different materials, including metals, ceramics, polymers, and composites; effect of atomistic structure, defects and microstructure on deformation and failure; deformation and failure mechanism maps and effects of temperature and deformation rate.

Course Prerequisites: MSEN 310, or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
1. Understand underlying atomistic mechanisms of deformation and failure in different materials, namely metals, ceramics, polymers and composites;
2. Identify deformation and failure mechanism in different materials;
3. Select appropriate strengthening and toughening strategies in different materials systems;
4. Predict a lifetime of structural components based on their dominant deformation and failure mechanisms;
5. Carry out failure analysis and determine origin of failure in structural components;

Textbook:

Additional Material:
N.E. Dowling, Mechanical Behavior of Materials, Prentice Hall, 1999

Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 Introduction: Concept and mathematical description of stresses and strains;
Week 2 Overview of Macroscopic mechanical behavior of materials; Stress-strain curves and constitutive relationships;
Week 3 Elastic deformation - Atomistic aspects and constitutive models;
Week 4 Plastic deformation mechanisms: dislocation based mechanisms;
Week 5 Plastic deformation mechanisms: twinning and kinking, diffusion based mechanisms, grain boundary sliding;
**Course Policies and Procedures:**

**Changes in schedule:**
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

**Assessment and Evaluation:**
Progress towards achieving learning outcomes will be evaluated through homework, exams, and final project. Peer review will be incorporated into the evaluation of final project reports and presentations.

**Grading Scale (Standard Letter Scale):**
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

**Grading Policies:**
Mid-semester exam (25%) {Week 6}
Final Exam (25%) {Week 15}
Project presentation and report (20%) {Week 14}
Homework assignments (30%) {Weekly}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

**Late Work Policy:**
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

**Attendance:**
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07). Please come on time. Silence cell phones and other electronic distractions.

**Make-up Policy:**
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are
expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

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3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at [http://attendance.tamu.edu](http://attendance.tamu.edu)
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
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MSEN 330, Numerical Methods for Materials Scientists and Engineers
Credits 3. 2 Lecture Hours, 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Xiaofeng Qian, Reed McDonald Bldg. 226, feng@tamu.edu, 979-458-9843

Course (catalog) description: The purpose of this course is to introduce students to the use of computing platforms to address scientific/engineering problems related to materials science and engineering. Emphasis will be placed on the use of computer programming to: analyze data, implement mathematical models of materials behavior, the use of numerical methods to solve materials-related problems.

Course Prerequisites: MSEN 230

Learning Outcomes: At the end of this course, students should be able to:
1. Use general scientific programming approaches to accelerate the analysis of materials data and to solve mathematical problems representing materials properties and phenomena.
2. Use numerical methods for the solution of non-linear equations associated with physical models of materials behavior.
3. Use numerical linear algebra to describe anisotropic properties of materials and to perform linear transformations.
4. Use least-squares methods for the parameterization of models with experimental data.
5. Use numerical differentiation and integration to quantify rates of change and cumulative changes in materials response.
6. Use numerical methods for the solution of ODEs/PDEs representing dynamic behavior in materials systems.
7. Use numerical optimization techniques for materials discovery and design.


Additional Material: Lecture notes, specific codes and subroutines, assignments, solutions, grades, project instructions, and additional material will be provided in the class or will be made available at http://ecampus.tamu.edu.

Course Outline:
Weeks 1-2 Introduction to Programming
Weeks 3-4 Solution to Non-linear Equations: Application to Constitutive Models of Materials Behavior
Weeks 5-6 Linear Algebra and Linear Transformations of Materials Anisotropic Properties
Week 7 Building models from data through least squares approaches
Weeks 8-9 Numerical integration and differentiation of materials response.
Weeks 10-11 Numerical solution to ODEs: reaction kinetics, dynamics of atoms in a crystal
Week 12 Numerical solution to PDEs: the diffusion equation in 1 D
Weeks 13-14 Constrained Optimization: From Gibbs Energies to Phase Diagrams
Course Policies and Procedures:

Changes in schedule: The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation: Proper understanding of the Numerical Methods commonly used by Materials Scientists and Engineers will be evaluated through projects and exams. The focus will be on the ability to solve a given problem using computer programming.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
In-Class Participation and quizzes (10 %)
Weekly Projects (60 %)
Exam #1 (15%) {Week 7}
Exam #2 (15%) {Week 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer's discretion.

Late Work Policy: No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance: The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy: If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

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2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1).
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student’s physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

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MSEN 340, Case Studies in Materials
Credits 2. 2 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information: Dr. Patrick Shamberger
Reed McDonald Bldg. 229, patrick.shamberger@tamu.edu, 979-458-1086

Course (catalog) description: Case studies illustrating materials science and engineering practice; systems analysis of repercussions for business and society; root causes of success and failure; design in the face of uncertainty; industry standards and regulatory frameworks; tradeoffs and cost-benefit analysis; ethical implications of engineering practice.

Course Prerequisites: MSEN 310

Learning Outcomes: At the end of this course, students should be able to:
6. Demonstrate critical thinking skills required in engineering practice through analysis of real-world examples
7. Illustrate trade-offs and system-level thinking with cases of both exemplary and poor materials selection or design
8. Show awareness of the role that materials scientists and engineers play in industry and the possible effect on society
9. Describe best practices in materials science and engineering in the face of uncertainty,
10. Introduce industry standards and regulatory frameworks,

Textbook:
• Engineering Ethics: Concepts and Cases, C. E. Harris, M. S. Pritchard, M. J. Rabins, R. James, E. Englehardt (Wadsworth, 2013)
• Modern Methods of Systems Engineering: With an Introduction to Pattern and Model Based Methods, J. Jenney, M. Gangl, R. Kwolek, D. Melton, N. Ridenour, M. Coe (CreateSpace, 2011)

Additional Material:
Additional materials for specific cases will be distributed by the instructor. Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 Case study 1: DH 106 Comet
Week 2 Introduction to engineering ethics; business implications of engineering design
Week 3 Case study 2: recycling and resource management
Week 4  Introduction to systems engineering and uncertainty  
Week 5-6  Exam 1; Teaming and assignment of final project topics  
Week 7  Case 3: turbine disk failure in United Airlines Flight 232  
Week 8  Introduction to engineering forensics  
Week 9  Site visit and/or presentations by faculty of practice  
Week 10  Case 4: the nuclear fuel cycle  
Week 11  Introduction to regulatory frameworks  
Week 12  Exam 2; special topic  
Week 13-14  Final project presentations  

Course Policies and Procedures:  
Changes in schedule:  
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.  

Assessment and Evaluation:  
Effective communication techniques will be evaluated through exams, and a written term project.  

Grading Scale (Standard Letter Scale):  
A = 90-100  
B = 80-89.99  
C = 70-79.99  
D = 60-69.99  
F = <60  

Grading Policies:  
Exam #1 (20 %) {Week 5}  
Exam #2 (20 %) {Week 12}  
Term Project (60%) {End of semester}  

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.  

Late Work Policy:  
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07 .  

Attendance:  
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07 . Please come on time. Silence cell phones and other electronic distractions.  

Make-up Policy:  
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.
The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

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2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at [http://attendance.tamu.edu](http://attendance.tamu.edu) or
      b) Confirmation of visit to a healthcare professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

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MSEN 370, Introduction to Computational Materials Science and Engineering
Credits 3. 2 Lecture Hours, 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Ankit Srivastava, Reed McDonald Bldg. 223, ankit.sri@tamu.edu, 979.458.9841

Course (catalog) description: Studio course introducing methods to simulate materials behavior across multiple scales; topics include: electronic structure calculations, classical molecular dynamics, computational thermodynamics and kinetics of materials, microstructure evolution simulation, continuum models of materials behavior.

Course Prerequisites: MSEN 210, MSEN 330

Learning Outcomes: At the end of this course, students should be able to:
1. Recognize the strengths and limitations associated with different computational materials modeling methods
2. Understand the basic structure of most materials simulation codes in terms of input(s), problem representation, simulation parameters and output(s)
3. Use basic functionality of electronic structure codes to calculate physical properties of model materials systems
4. Use classical molecular dynamics to simulate dynamic behavior of collections of atoms
5. Use computational thermodynamics software to calculate phase stability in multi-component systems
6. Use computational kinetics software to quantify rates of transformation in materials
7. Use microstructure evolution software to simulate simple phase transformations


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 Using Models to Represent Reality
Week 2 The basic Ingredients of Materials Simulation: Inputs, Problem Representation, Simulation Parameters and Outputs.
Week 3 Basics of Electronic Structure Simulations: Density Functional Theory in a Nutshell
Week 4 Using VASP/ABINIT to Calculate Equations of State of Simple Crystals
Week 5 Molecular Dynamics: Applying F=ma at the atomic scale
Week 6 Using LAMMPS to Simulate Melting of a Polymer
Week 7 Computational Thermodynamics: Minimizing Gibbs Energies
Week 8 Using Thermo-Calc to calculate the phase diagram in multi-component Ceramic System
Week 9 Computational Kinetics: Connecting Diffusion to Phase Transformations
Week 10 Using DICTRA to simulate the motion of an fcc/bcc interface in stainless steels
Week 11 Microstructure Evolution Simulations: The Phase Field Method
Week 12 Using FiPy to Simulate Spinodal Decomposition in a Bio-material
Week 13 Challenges and Opportunities in Computational Materials Science
Week 14 Multi-scale Computational Materials Science: Bridging Scales

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course will be evaluated through quizzes and projects.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Quizzes: 20%  
Project 1:  20% {Week 4}
Project 2:  25% {Week 8}
Project 3:  35% {Week 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer's discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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Make-up Policy:
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MSEN 400, Design and Analysis of Materials Experiments
Credits 3. 2 Lecture Hours/3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. K. T. Hartwig, Reed McDonald Bldg. 220, thartwig@tamu.edu, 979-845-1585

Course (catalog) description: Systematic design of experimental investigations; student teams identify topics in consultation with the instructor and develop experiment designs including establishing the need, associated requirements and objective; conduct experiments; characterize materials; analyze and interpret results; documenting the procedures, analysis, results, and conclusions; present written and oral reports.

Course Prerequisites: MSEN 220, MSEN 302, and MSEN 320

Learning Outcomes: At the end of this course, students should be able to:
1. Establish the justification for an experiment, that is, why are the results needed or desired?
2. Establish specific objectives of an experiment.
3. Establish the budgetary, manpower and time requirements, including time sequencing of the project, and schedule for a project.
4. Establish the primary variables that must be controlled and measured by applying engineering fundamentals to determine the theory that describes the phenomena under investigation.
5. Identify clearly what the response variables (dependent variables) are and what the controlled variables (independent variables) are for a particular experiment.
6. Determine specific tasks (functions) that must be completed to conduct the experiment.
7. Determine if a Standard or Recommended Practice exists for conducting the experiment.
8. Determine the uncertainty (confidence intervals) which may be required for the primary measurements, and the number and spacing of such measurements required for proper data analysis and presentation of results.
9. Identify extraneous variables that might influence the results of an experiment and how they may be suppressed.
10. Determine whether measurements should be taken randomly or sequentially and design a test plan.
11. Determine if a factorial or fractional factorial experiment design can or should be used and design one if needed.
12. Set up data reduction calculations before conducting the experiment to be sure that adequate useful data will be collected to meet the objectives of the experiment.
13. Analyze the possible uncertainty in the anticipated results before an experiment is conducted so that modifications in uncertainty requirements on the various measurements may be changed if necessary.
14. Select instrumentation for the various material characterizations and measurements to match the anticipated uncertainty requirements. Modify the instrumentation to match budgetary, performance, and schedule limitations if necessary.
15. Conduct a preliminary analysis after collecting a few data points to make sure that the experiment is progressing as planned, and modify the experimental apparatus and/or procedure in accordance with the preliminary findings.
16. Conduct an experiment by doing materials characterizations and taking the experimental data, and presenting the results in a manner such that they can be analyzed and interpreted relevant to the objective of the experiment.
17. Test experimental results for consistency and rejection or outliers.
18. Apply statistical analysis to the results such as analysis of variance (ANOVA) or multiple regression analysis to aid in interpreting the results and determining their significance.
19. Discuss the results of an experiment relative to the objectives to: interpret the results; explain any discrepancies, scatter of data, or anomalies in the results; point out most important results; and provide a lead
in to the conclusions of the experiment.
20. Summarize findings of an experiment, draw conclusions, and make recommendations.
21. Organize and prepare a report describing the justification, objectives, experimental setup and procedures, findings, results, and conclusions of an experiment in writing and orally.

**Textbook:**

**Additional Material:** Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at [http://ecampus.tamu.edu](http://ecampus.tamu.edu).

**Course Outline:**
Week 1: Introduction to course and the general experimental design process, relationship to general design process.
Week 2: General planning of experimental investigations, establishing project objectives, application of systems engineering design process to experiments, identifying types of experiments, standards and recommended practices, identifying and organizing tasks, and preparing an experiment project proposal.
Week 3: Use of uncertainty analysis in the planning of experiments, statistical analysis for experiments, relationship of number of significant figures reported and uncertainty, confidence intervals, data acquisition and data checking.
Week 4: Preparing written reports of experiments, format for general report, difference between findings and conclusions.
Week 5: Continuation of interpretation, presentations and reporting of results, reports in industry.
Week 6: Detailed design of experimental investigations; determination of number and spacing of data points.
Week 7: Detailed design of experimental investigations; test sequences and experimental plans.
Week 8: Detailed design of experimental investigations; random designs, suppression of extraneous variables.
Week 9: Detailed design of experimental investigations; mathematical modeling of experimental results.
Week 10: Introduction to statistical Design of Experiments (DOE)-factorial design
Week 11: Fractional Factorial Design of Experiments, oral presentations.
Week 12: Analysis of variance (ANOVA) for single, two and three factor experiments.
Week 13: Multiple regression analysis.
Week 14: Student presentations

**Class/laboratory Schedule:** Two 50 minute lectures per week plus one 3 hour lab session per week where students work in teams of 3 or 4.

**Relationships Between ABET and Course Program Outcomes:**

<table>
<thead>
<tr>
<th>ABET Program Outcome</th>
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<tr>
<td>x a. ability to apply knowledge of mathematics, science and engineering</td>
<td>f. understanding of professional and ethical responsibility</td>
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<tr>
<td>x b. ability to design and construct experiments, and analyze and interpret data</td>
<td>x g. ability to communicate effectively</td>
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<tr>
<td>x c. ability to design a system, component, or process to meet desired needs within realistic constraints</td>
<td>h. education to understand the impact of engineering solutions in a global, economic, environmental, and societal context</td>
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<tr>
<td>x d. ability to function on multi-disciplinary teams</td>
<td>i. recognition of the need for, and an ability to engage in life-long learning</td>
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<td>x e. ability to identify, formulate and solve engineering problems</td>
<td>j. a knowledge of contemporary issues</td>
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<td></td>
<td>x k. ability to use the techniques, skills and modern engineering tools necessary for engineering practice</td>
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</tbody>
</table>
Course Policies and Procedures:
Changes in schedule:
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Assessment and Evaluation:
Understanding of fundamental concepts of Materials Science and Engineering will be evaluated through two in-class exams, and through a final group term paper relating design and engineering of material properties for specific technological applications.

Student understanding will be assessed throughout class in the form of quizzes, HWs, and in-class group activities, to ascertain that students are meeting desired learning outcomes.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grade Components:
Two Written Proposals (team) 25%
Two Written Reports (team) 25%
Final Oral Report (team) 10%
Quizzes (individual) 10%
Lab Performance (individual) 10%
Final Exam (individual) 20%

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
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Attendance:
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MSEN 401 Materials Research and Design I  
Credits: 3. 2 Lecture Hours/3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:  
Dr. Ramesh Talreja, HRBB 736A, talreja@tamu.edu, 979.458.3256

Course (catalog) description: The research and design process; need definition, functional analysis, performance requirements, evaluation criteria, conceptual design evaluation; introduction to systems engineering; parametric and risk analysis, failure analysis, material selection, and manufacturability; cost and life cycle issues, project management; topics will come from sponsored research or an industry-sponsored design project.

Course Prerequisites: MSEN 281, MSEN 340, MSEN 400

Learning Outcomes: At the end of this course, students should be able to:
1. Recognize the stages of a generalized design process; explain what activities occur during each stage; distinguish among the products of each stage.
2. Apply the early stages of a generalized design process.
3. Analyze client/sponsor requests in order to identify quantitative design requirements.
4. Identify sources of information and differentiate among them to determine which are useful.
5. Develop a function structure by abstraction based on design requirements.
6. Apply innovation methods to generate conceptual design solutions.
7. Determine whether you have encountered fixation during concept generation and apply corrective action if necessary.
8. Describe the differences among concept sources such as database-driven, computational/modeling, or analytical-driven approaches.
9. Evaluate concepts and select the most viable.
10. Recognize the triple constraint (cost, time, performance) and its effects on project management.
11. Produce a suitable work breakdown structure for accomplishing a design task.
12. Assess risk in a project and assign appropriate contingency.
13. Employ software tools to manage projects.
14. Develop a personal approach for successfully participating on a design team.
15. Record all project related developments in a design project notebook.
16. Communicate the results of a design orally and in writing.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.
Course Outline:
Week 1: Introduction to design and project management
Week 2: Creating a Work Breakdown Structure, effective team participation
Week 3: Using project management software, functional representation of needs
Week 4: Methods of tracking project status, abstracting and producing a function structure
Week 5: Revising function structures and obtaining customer agreement
Week 6: Introduction of cognitive perspective of innovative behavior
Week 7: Using intuitive innovation methods
Week 8: Using logical innovation methods
Week 9: Applying innovation within an entrepreneurial activity, introduction of intellectual property
Week 10: Evaluating design concepts and selection methods
Week 11: Identifying information sources, making informed design decisions
Week 12: Embodying selected design concepts
Week 13: Communicating design information
Week 14: Presenting detailed conceptual designs to customers

CLASS/LABORATORY SCHEDULE: Two, 50 minute lecture sessions per week that overview engineering design principles. Studio sessions meet once per week outside of lecture to work on project teams focused on a specific research project, interdisciplinary senior design activity in coordination with another engineering department, or an industry-sponsored design project.

Course Policies and Procedures:
Changes in schedule:
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Assessment and Evaluation:
Understanding of fundamental concepts of Materials Science and Engineering will be evaluated through two in-class exams, and through a final group term paper relating design and engineering of material properties for specific technological applications.

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Grading Scale (Standard Letter Scale):
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Grading Components:
Home Work 10%
Quizzes 10%
Exam 20%
Final Presentation 20%
Final Design Report 30%
Performance on Team 10%

Late Work Policy:
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MSEN 402 Materials Research and Design II  
Credits 3.  2 Lecture Hours/ 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:  
Dr. Ramesh Talreja, HRBB 736A, talreja@tamu.edu, 979.458.3256

Course (catalog) description: Continuation of MSEN 401; development of innovative solutions to research or industry-provided design challenges; structured framework and methodology for design activities; innovation, computational materials science, synthesis/processing, and analysis/characterization of material components; project definition, management, customer interaction and effective team participation; presentations and design reviews.

Extended description: In this second capstone design course, in which the engineering design and development process from need definition to embodiment, and the development of innovative solutions to real-world, and research or industry-provided design challenges will be addressed. A structured framework and methodology for design activities is emphasized and practiced through its application to challenging design tasks that are addressed by small design teams in complementary design studios. The design activity includes innovation, computational materials science, synthesis/processing, and analysis/characterization of material components, as well as project definition, management, customer interaction and effective team participation. Exposure to these topics occurs through participation in an intensive client-sponsored design project. Presentations and design reviews are conducted with technical staff from the partner-sponsor, and formal reports are prepared and submitted as evidence of participation and demonstration of hands-on design skills developed.

Course Prerequisites: MSEN 401

Learning Outcomes: Students who successfully complete this course should be able to design a material system, component or process to meet desired performance requirements within realistic constraints that include economic, social, political, environmental, ethical, health and safety, as well as manufacturability and sustainability. At the end of this course, you should be able to:
1. Comprehend the product design and development process, and the engineer’s role.
2. Define all environmental factors that may affect the material/component.
3. Select suitable material configurations and manufacturing processes.
4. Select theories of failure and failure modes from environmental conditions.
5. Select preliminary design margins by performing adequate risk analyses.
6. Develop final material requirements from design margins for each failure mode.
7. Define final material properties for all conceivable circumstances.
8. Perform computation based materials modeling and analyses.
9. Select developmental models, processes and procedures to evaluate material failure modes.
10. Define the new product (process) by converting functional properties into performance properties, and prepare final product (synthesis/processing) protocols.
11. Prepare final product design report and present final product presentation to sponsor.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Topics:
- Engineering Design Overview
- Design Principles
- Design Optimization
- Materials Selection and Processing
- Computation and Modeling
- Design for Manufacturing, for Assembly, and for Inspection
- Product Liability
- Failure Mode and Effects Analysis (FMEA)
- Risk Assessment, Risk Analysis, and Risk Management
- Total Quality Management
- Life-Cycle Cost Analysis and sustainability
- Patents and Intellectual Property

CLASS/LABORATORY SCHEDULE: Two lecture sessions per week that overview engineering design principles, plus a studio session that meets once per week for work on project teams devoted to a specific research or industry-sponsored design project.

RELATIONSHIP OF MSEN 402 COURSE TO ABET PROGRAM OUTCOMES:

<table>
<thead>
<tr>
<th>ABET Program Outcome</th>
<th>ABET Program Outcome</th>
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</thead>
<tbody>
<tr>
<td>x a. ability to apply knowledge of mathematics, science and engineering</td>
<td>x f. understanding of professional and ethical responsibility</td>
</tr>
<tr>
<td>x b. ability to design and construct experiments, and analyze and</td>
<td>x g. ability to communicate effectively</td>
</tr>
<tr>
<td>x c. ability to design a system, component, or process to meet desired needs within</td>
<td>x h. education to understand the impact of engineering solutions in a global, economic, environmental, and societal context</td>
</tr>
<tr>
<td>x d. ability to function on multi-disciplinary teams</td>
<td>x i. recognition of the need for, and an ability to engage in lifelong learning</td>
</tr>
<tr>
<td>x e. ability to identify, formulate and solve engineering problems</td>
<td>x j. a knowledge of contemporary issues</td>
</tr>
<tr>
<td>x</td>
<td>x k. ability to use the techniques, skills and modern engineering tools necessary for engineering practice</td>
</tr>
</tbody>
</table>

Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

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Assessment and Evaluation:
Understanding of fundamental concepts of Materials Science and Engineering will be evaluated through two in-class exams, and through a final group term paper relating design and engineering of material properties for specific technological applications.

Student understanding will be assessed throughout class in the form of quizzes, HWs, and in-class group activities, to ascertain that students are meeting desired learning outcomes.

Grading Scale (Standard Letter Scale):
A = 90-100; B = 80-89.99; C = 70-79.99; D = 60-69.99; F = <60

Grading Components:
Home Work 10%
Quizzes 10%
Exam 20%
Final Presentation 20%
Final Design Report 30%
Performance on Team 10%

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university -excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

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2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)

ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
   a) Texas A&M University Explanatory Statement for Absence from Class form available at [http://attendance.tamu.edu](http://attendance.tamu.edu) or
   b) Confirmation of visit to a health care professional affirming date and time of visit.

7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

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Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: [http://aggiehonor.tamu.edu](http://aggiehonor.tamu.edu).

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MSEN 410, Materials Processing,

Credits 3. 2 Lecture Hours, 3 Lab Hours

Term:  Fall 2017

Meeting times and locations:  TBD

Instructor Information:

Dr. Miladin Radovic, Reed McDonald Bldg. 216, mradovic@tamu.edu, 979-865-5114

Course (catalog) description:  The course will provide an introduction to synthesis, properties and processing of technologically important inorganic materials (metals and ceramics). Topics covered will include thermodynamics and kinetics of different materials processing methods, casting, deformation processing, heat treatments, powder processing and sintering, coating and thin films processing, etc.

Course Prerequisites:  MSEN 201 MSEN 222, AERO 413, BMEN 343, CHEN 313, CVEN 306, ENTC 206, or NUEN 265, or approval of instructor; junior or senior classification.

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Understand basic thermodynamics and kinetics of phase transformations and chemical reactions in materials processing.
2. Describe in details different available conventional methods for processing materials (metals & ceramics) properties and understand their advantages and limitations in terms of final microstructure, cost, energy and power requirements, shape limitations and dimensional tolerances, and time to manufacture components.
3. Select conventional processing method and determine optimal processing parameters to achieve specified microstructure and properties of materials;
4. Understand principles of advanced processing methods and their advantages and limitations.

Required Textbook:

The Production and Processing of Inorganic Materials, James W. Evans and Lutgard C. De Jonghe

Related Textbooks:

There are several good textbooks available in the Library covering related course material. In these books, the information covered in the course is approached in different ways and with different perspectives than in required textbook, which may make the principles described easier to understand. In addition, some of the figures and tables in other textbooks may make it easier to understand the topics covered. The following books are recommended, but are not required reading for this course:

The Science and Engineering of Materials, Donald R. Askeland, Pradeep P. Fulay, and Wendelin J. Wright

Materials Processing, James H. Swisher
Materials Science in Manufacturing, Rajiv Asthana, Ashok Kumar and Narendra Dahotre

Engineering Materials 2, Michael F. Ashby and David R.H. Jones

Ceramic Processing, Mohamed N. Rahaman

Additional Material:

Lecture notes (including topics that are not covered in the required textbook), assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu. Library resources (including supplementary reading material, materials reference handbooks, standards databases and video links) will be available at: http://guides.library.tamu.edu/MSEN410.

Assessment and Evaluation:

Understanding of course material will be evaluated through both conceptual questions and numerical problems in which relevant physical quantities will be calculated from fundamental relationships. Assigned practice problems and Tests will play important roles in gaining a mastery of the course material.

Course Policies and Procedures:

Changes in schedule:

The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Grading Scale (Standard Letter Scale):

A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:

Test#1 (20 %) {Week 5}
Test#2 (20 %) {Week 10}
Test#3 (20 %) {Week 13}
Comprehensive Final (30 %) {End of semester}
Project (10 %)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:

No late work will be accepted, except in the case of an excused absence.

Attendance:

The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located

**Make-up Policy:**

If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence. The reasons absences are considered excused by the university are listed below. See Student Rule 7 for details ([http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1) Participation in an activity that is required for a class and appears on the university authorized activity list at [https://studentactivities.tamu.edu/app/sponsauth/index](https://studentactivities.tamu.edu/app/sponsauth/index)
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7) Required participation in military duties.

8) Mandatory admission interviews for professional or graduate school that cannot be rescheduled. Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

**Course Outline** (subject to change):

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Chapter(s)</th>
</tr>
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<td>Course Introduction:</td>
<td>1</td>
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<td>1/2</td>
<td>Thermodynamics of chemical reactions and phase transformations in metals and ceramics.</td>
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<td>3</td>
<td>Diffusion and Kinetics of chemical reactions and phase transformations in metals and ceramics processing;</td>
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<td>4</td>
<td>Production of metals and glasses</td>
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<tr>
<td>5</td>
<td>Casting and solidification of metals and glasses;</td>
<td>10</td>
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<td>5</td>
<td>Test 1</td>
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<td></td>
<td>Powders and particles; Productions of powders;</td>
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<td>---------------------------------------------</td>
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<tr>
<td>7</td>
<td>Powder compaction;</td>
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<td>8</td>
<td>Sintering and densification technologies;</td>
<td>13, 14, 15</td>
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<td>9</td>
<td>Heat treatment and deformation processing of metals;</td>
<td>**</td>
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<tr>
<td>10</td>
<td>Test 2</td>
<td></td>
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<tr>
<td>10</td>
<td>Coating and Surface Engineering</td>
<td>**</td>
</tr>
<tr>
<td>11</td>
<td>Nanomaterial and Nonmanufacturing</td>
<td>**</td>
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<tr>
<td>12</td>
<td>Overview of advanced materials processing</td>
<td>16</td>
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<td>13</td>
<td>Process Engineering</td>
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<td>Test 3</td>
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<td>14</td>
<td>Project presentations</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Comprehensive Final Exam</td>
<td></td>
</tr>
</tbody>
</table>

*Subject to changes. Changes will be posted on [http://e-campus.tamu.edu](http://e-campus.tamu.edu)

** Topic is not covered in the required textbook. Students will be provided with lecture notes and recommendations for additional readings.

**Academic Integrity:**

Aggie Honor Code: “An Aggie does not lie, cheat, or steal or tolerate those who do.” Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System. For additional information please visit: [http://aggiehonor.tamu.edu](http://aggiehonor.tamu.edu)

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MSEN 415, Defects in Solids
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Michael J. Demkowicz, Reed McDonald Bldg. 231, 979.845.0750

Course (catalog) description: Overview of point, line, and surface defects in solids; relates defect properties to diffusion, deformation, phase transformations; focuses on atomic defects in crystals, with additional examples from liquid crystals, superconductors, and ferromagnets; incorporates atomistic modeling to examine defect structure.

Course Prerequisites: MSEN 310 or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
• Define and explain the structures and properties of point and electronic, line, and planar defects
• Describe mathematically the mutual interactions between defects
• Explain how the structure and properties of defects give rise to macroscale materials behaviors, such as diffusion, plastic deformation, and electrical/magnetic/optical properties.
• Construct atomistic models of defects, visualize the defects in these models, and use the models to compute defect properties

Textbooks:
D. Hull and D. J. Bacon, Introduction to Dislocations (Butterworth Heinemann, 2006)

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:

Point defects:
Week 1 Vacancies and interstitials
Week 2 1st atomistic modeling tutorial; multipole expansion
Week 3 Defect reactions; 2nd atomistic modeling tutorial
Week 4 Defects in multicomponent systems; defects in amorphous solids

Line defects:
Week 5 Ideal shear strength; Topology of dislocations
Week 6 Dislocation-point defect interactions; configurational forces on dislocations
Week 7 Midterm; Plastic deformation through dislocation glide
Week 8 Dislocation climb; Dislocation-obstacle interactions
Week 9 Strengthening mechanisms; stacking faults; dislocation reactions
Week 10 Hardening; dislocations in 2-D materials; line defects in liquid crystals, superfluids, and superconductors

Planar defects:
Week 11 Free surfaces; terrace-ledge-kink model
Week 12 Grain boundaries; coincident site lattices
Week 13 Heterophase interfaces; O-lattice theory; magnetic domain walls
Week 14 Final project presentations

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Progress towards achieving learning outcomes will be evaluated through homework, exams, and final project. Peer review will be incorporated into the evaluation of homework assignments.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Midterm (25%) {Week 5}
Final comprehensive exam: (25%)
Final project presentation (25%) {Week 14}
Homework (25%) {Weekly}

Course will not be graded on a curve.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

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9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

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MSEN 420, Polymer Science
Credits 3. 3 Lecture Hours
Term: Fall 2017
Meeting times and locations: TDD
Instructor Information:
Dr. Svetlana Sukhishvili, RDMC 221, svtlana@tamu.edu, 979-458-9840

Course (catalog) description: Types of polymerization and molecular characteristics of polymer chains; single chain statistics and rubber elasticity; phase transitions, glass transition, viscoelasticity and time-temperature superposition; polymer structure at the molecular, microscopic and macroscopic levels; polymer thermosets, thermoplastics, elastomers, fibers, and advanced nanoparticle-filled composites.

Course Prerequisites: PHYS 208, CHEM 102, CHEM 112, or approval of instructor

Learning Outcomes: At the end of this course, students should be able to:
1. Recognize main types of polymerization reactions, and relate type of polymerization to polymer properties.
2. Define and differentiate between polymer conformations and configurations.
3. Give a quantitative description of single chain conformations in polymer melts and solutions, and relate the single polymer chain statistics with rubber elasticity.
4. Differentiate between thermodynamic and kinetic phase transitions in polymers.
5. Recognize main features of viscoelastic behavior in polymers.
6. Explain and apply the concept of time-temperature superposition to a polymer material.
7. Differentiate between and identify distinct properties of thermosets and thermoplastics.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1  Introduction to polymers. Classification of polymers based upon molecular structure
Week 2  Polymerization mechanisms
Week 3  Chain conformation and configuration
Week 4  Molecular weight and molecular weight distributions
Week 5  Polymer solutions, amorphous polymers
Week 6  Phase transitions and glass transition in polymers
Week 7  Amorphous state of polymers
Week 8  Crystalline state in polymers
Week 9  Thermal transitions in polymers
Week 10 Mechanical properties of polymers
Week 11 Time-temperature superposition
Week 12 Viscoelasticity of polymer solution and melts
Week 13 Rubbers and gels
Week 14 Thermoplastics and thermosets. Polymer composites.
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Progress towards achieving learning outcomes will be evaluated through graded problem sets, midterm and final exam, and a literature assignment.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Problem sets: 20% {Weekly}
Midterm exams: 30% {Weeks 4 & 8}
Literature assignment: 10%
Final exam: 30%

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
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Attendance:
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Make-up Policy:
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The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.
1. Participation in an activity that is required for a class and appears on the university authorized activity list at [https://studentactivities.tamu.edu/app/sponsauth/index](https://studentactivities.tamu.edu/app/sponsauth/index).

2. Death or major illness in a student's immediate family.

3. Illness of a dependent family member.

4. Participation in legal proceedings or administrative procedures that require a student's presence.

5. Religious holy day. NOTE: Prior notification is NOT required.

6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1).
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at [http://attendance.tamu.edu](http://attendance.tamu.edu) or
      b) Confirmation of visit to a health care professional affirming date and time of visit.

7. Required participation in military duties.

8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.

9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.

10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**

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**Americans with Disabilities Act (ADA) Policy Statement:**

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MSEN 426, Polymer Laboratories
Credits 3. 2 Lecture Hours, 3 Lab Hours.

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. H.-J. Sue, Reed McDonald Bldg. 222, hjsue@tamu.edu, 979-845-5024

Course (catalog) description: Laboratory class to prepare students who are interested in polymer research with necessary experimental and analytical skills to conduct and analyze experimental work.

Course Prerequisites: MSEN 250; or approval of instructor

Learning Outcomes: At the end of this course, students should be able to:
1. Demonstrate practical knowledge of polymer experimental techniques,
2. Describe the theory behind different experimental techniques,
3. Accurately and succinctly describe laboratory results.

Textbook: None.

Additional Material:
Experiments in Polymer Science, by E.A. Collins, J. Bares, and P.W. Billmeyer, JR. (Wiley)
Polymer: Polymer Characterization and Analysis, Jacqueline L. Kroschwitz
Instrumental Methods of Analysis, Hobart H. Willard
Physical Properties of Polymers Handbook, James E. Mark

Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1  Course Introduction
Week 2  Polymerization of Styrene
Week 3  Curing of Epoxy
Week 4  Rubber Swelling
Week 5  Thermal Gravitational Analyzer
Week 6  Density Measurements
Week 7  Surface Roughness Measurements
Week 8  Fracture Toughness
Week 9  Fourier Transform Infrared Spectroscopy
Week 10 Scratch Test
Week 11 Tensile Test
Week 12 DSC
Week 13-14 Summary and Data Analysis
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Evaluation of knowledge regarding experimental techniques will be evaluated through a combination of Lab results, Lab reports, Presentations, and a Final Exam

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Lab Performance 15%
Lab Reports 45% \{Weekly\}
Presentation 15% \{Week 14\}
Final Exam 25%

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

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1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
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      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
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Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

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MSEN 430, Nanomaterials Science
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Ibrahim Karaman, Reed McDonald Bldg. 235, ikaraman@tamu.edu, 979-862-3923

Course (catalog) description: Nanotechnology and nanomaterials; types, fabrication, characterization methods, and applications; their current roles in technology, and the likely future impact of such systems on industry targeting.

Course Prerequisites: MSEN 310, junior or senior classification; or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
1. define nanotechnology and nanoscience
2. explain the effects of size scales on materials behavior
3. perform analysis using scaling laws to show why size scales affect certain materials response.
4. explain the new phenomena observed on the nanoscale
5. describe types of nanomaterials.
6. explain the basic principles and types of nanomaterials fabrication.
7. select appropriate techniques for fabricating nanostructures from different types of materials.
8. comprehend the limitation of conventional characterization techniques and learn about major characterization tools for the nanostructured materials.
9. design experiments to characterize and determine properties of a given nanomaterial.
10. provide multiple examples of current and predicted applications of nanomaterials.

Textbook: None.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ccampus.tamu.edu.

Course Outline:
Week 1 Public Awareness of Nanotechnology
Week 2 Effect of Size Scaling: Thermal Properties
Week 3 Effect of Size Scaling: Mechanical Properties
Week 4 Effect of Size Scaling: Electrical Properties
Week 5 Effect of Size Scaling: Magnetic Properties
Week 6 Effect of Size Scaling: Optical Properties
Week 7 New Behavior: surfaces
Week 8 New Behavior: Sticky/Shaky/Bumpy
Week 9 Nanostructured materials: shapes
Week 10 Nanostructured materials: applications
Week 11 Fabrication of Nanomaterials: Top-down approaches
Week 12 Fabrication of Nanomaterials: Bottom-up approaches
Week 13-14 Introduction to Nanomaterials Characterization methods
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The student progress will be evaluated through a combination of homework, a final exam, two laboratory experiments and reports, a term project and class presentation.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Homework (25%) {Weekly}
Laboratory Reports (20%) {Weeks 4 & 8}
Final Exam (35%) {End of semester}
Term Project (20%) {Week 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

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3. Illness of a dependent family member.
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Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

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MSEN 440, Materials Electrochemistry and Corrosion  
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:  
Dr. Li Liu, Reed McDonald Bldg. 227, li.liu@tamu.edu, 979-458-1090

Course (catalog) description: Survey of thermodynamic and kinetic fundamentals of electrochemistry; multiscale materials corrosion mechanisms; details of interfacial aqueous electrochemical mechanisms and the environmental effects when materials are exposed to different conditions.

Course Prerequisites: MSEN 220; or approval of instructor

Learning Outcomes: At the end of this course, students should be able to:
- Describe fundamental corrosion mechanisms,
- Demonstrate the use of modern engineering tools necessary for understanding basic principles in materials electrochemistry and corrosion,
- Apply math, chemistry, and physics, to problems in corrosion.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:  
<table>
<thead>
<tr>
<th>Course Outline</th>
<th>Textbook Chapter</th>
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<tbody>
<tr>
<td>1 Introduction to electrochemical cells and chemistry (potential redox, potential, pH)</td>
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<tr>
<td>2 Charged Interfaces (Electrolytes, Electrical double layer, potentials)</td>
<td>3</td>
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<tr>
<td>3 Thermodynamics review (State functions, Chemical potential, Nernst expression)</td>
<td>4</td>
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<td>4 Thermodynamics of materials electrochemistry (Electrochemical cells)</td>
<td>5</td>
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<td>5 Electrochemical Thermodynamics (E-pH diagrams at different conditions)</td>
<td>6</td>
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<td>6 Exam 1</td>
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<td>7 Kinetics of materials electrochemistry (Methods of determining corrosion rates by electrochemical testing)</td>
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<td>8 Electrochemical polarization (Electrode kinetics for activation polarization)</td>
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<td>9 Concentration polarization and Diffusion</td>
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<td>10 Fundamentals on concentration polarization and corrosion</td>
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<tr>
<td>11 Exam 2</td>
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</tbody>
</table>
Application to surface conditions of materials (Corrosion and Passivity)
Application to Energy Devices (Batteries, Fuel Cells and Capacitors)
Applications to Environment and Health (Bioelectrochemistry, Biomaterials)

Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Effective knowledge of fundamental electrochemistry and corrosion mechanisms will be evaluated through homework, course projects, and exams.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Homework (30%) {Weekly}
Projects (40%) {Weeks 4 & 8}
Exams (30%) {Weeks 6 & 11}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer's discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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Make-up Policy:
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-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

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3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student’s presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
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      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

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MSEN 444, CORROSION AND ELECTROCHEMISTRY LABORATORY
Credits 3. 2 Lecture Hours, 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information: Dr. Homero Castaneda
Reed McDonald Bldg. 230, hcastaneda@tamu.edu, 979-458-9844

Course (catalog) description: Laboratory practice and principles for corrosion and electrochemistry methods; students will design, carry out, and analyze a series of labs illustrating the most important techniques in the field; course builds to an open-ended corrosion engineering problem resulting in preparation of a technical report for a hypothetical client.

Course Prerequisites: MSEN 440

Learning Outcomes: At the end of this course, students should be able to:
1. Demonstrate ability to use reference electrodes.
2. Demonstrate ability to conduct electrochemical and weight loss measurements of corrosion rate.
3. Demonstrate ability to generate potentiodynamic polarization curves to study passivity and localized corrosion.
4. Demonstrate ability to conduct measurements of polarization resistance
5. Demonstrate ability to use metallographic methods for sample preparation and analysis.
6. Demonstrate ability to design experiments to characterize and study electrochemical/corrosion systems.

Textbook: Electrochemical Techniques in Corrosion Testing and Research, John Scully Editor, 1983

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
1 Introduction, laboratory safety
2 Lab 1: Materials sample and preparation (Metallography)
3 Lab 2. Materials Characterization (Microscopy)
4 Lab 3: Corrosion Rate, Weight Loss vs. Potentiostatic measurements
5 Lab 4: Tafel Slopes and Linear Polarization Resistance
6 Lab 5: Potentiodynamic Polarization, Active to Passive Transitions
7 Lab 6: Pitting Corrosion
8 Pitting corrosion (cont.)
9 Lab 7: Coatings
10 Lab 8: Cathodic Protection (galvanic anodes, impressed current)
11 Lab 9: Cathodic protection (coatings)
12 Lab 9: Batteries Characterization
13 Lab 10: Supercapacitors characterization
14 Final Exam
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
There will be ten laboratory assignments during the semester. For each laboratory assignment students are expected to produce a short individual technical report, which will be used to grade the assignment.

One final objective is to solve an open-ended corrosion engineering question for a hypothetical client. The student will design, carry out and analyze several corrosion experiments. The culmination of this analysis will be a report detailing the work and experimental approach as well as recommendations to the client.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Homework (30%) {Weekly}
Term Project (40%) {Week 13}
Exams (30%) {Weeks 8 & 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
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MSEN 446, CORROSION PREVENTION AND CONTROL METHODS
Credits 3. 3 Lecture Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information: Dr. Homero Castaneda
Reed McDonald Bldg. 230, hcastaneda@tamu.edu, 979-458-9844

Course (catalog) description: Cathodic protection and coatings as corrosion prevention and control methods for different applications; functional engineering approach to controlling and preventing aqueous corrosion based on engineering methodologies; impressed current, galvanic anodes, organic, inorganic and hybrid coatings; case of studies in the oil and gas, energy, automotive and different industries are included to illustrate the application of each method.

Course Prerequisites: MSEN 440; MSEN 444; MEEN 360

Learning Outcomes: At the end of this course, students should be able to:
- Demonstrate ability to use fundamentals and basics for cathodic protection design for different metallic structures.
- Demonstrate ability to select the most suitable action and solution for corrosion control and mitigation (coatings and cathodic protection) based on the system conditions.

Textbook: Morgan, Cathodic Protection, NACE.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
1. Overview of Corrosion Science and Engineering
2. Concept of Cathodic Protection
3. Cathodic Protection Systems
4. Field Measurements
5. CP design fundamentals and applications
6. Stray Currents
7. Evaluation of CP System Performance
8. Coating Fundamentals
9. Coatings types and curing mechanisms
10. Coatings types and curing mechanisms
11. Coatings surface preparation
12. Surface preparation instrumentation
13. Subsea case of studies in prevention and corrosion control
14. Oil and gas cases of study for cathodic protection design and coatings application
**Course Policies and Procedures:**

*Changes in schedule:*
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

*Assessment and Evaluation:*
Knowledge of corrosion prevention and control methods will be evaluated through homework, exams, and completion of class projects.

*Grading Scale (Standard Letter Scale):*
- A = 90-100
- B = 80-89.99
- C = 70-79.99
- D = 60-69.99
- F = <60

*Grading Policies:*
- Homework (30%) *(Weekly)*
- Project (30%) *(Week 13)*
- Participation (Quizzes) (10%)
- Exams (30%) *(Weeks 8 & 14)*

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

*Late Work Policy:*
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

*Attendance:*
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07). Please come on time. Silence cell phones and other electronic distractions.

*Make-up Policy:*
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at [https://studentactivities.tamu.edu/app/sponsauth/index](https://studentactivities.tamu.edu/app/sponsauth/index)
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

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MSEN 458, Fundamentals of Ceramics
Credits 3. 3 Lecture Hours

Stacked with MSEN 658
Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Miladin Radovic, Reed McDonald Bldg. 216, mradovic@tamu.edu, 979-845-5114

Course (catalog) description: Structure-property relationships of ceramics and ceramic composites; atomic bonding in ceramics; crystalline and glassy structures; phase equilibria and ceramic reactions; mechanical, electrical, thermal, dielectric, magnetic, and optical properties; and ceramic processing; different properties of ceramics will be related to their underlying structure.

Course Prerequisites: MSEN 310; or approval of instructor

Learning Outcomes: At the end of this course, students should be able to:
- Recognize basic structures of ceramics and glass;
- Correlate processing conditions to the structure of ceramics and glasses;
- Correlate properties of ceramics and glasses to their structure;
- Select ceramic materials for different applications;
- Design components from ceramics and glasses.


Additional Material:

Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:

Week 1  Bonding in Ceramics
Week 2  Structure of Ceramics
Week 3  Thermodynamic and Kinetic Considerations
Week 4  Phase Equilibria
Week 5  Effects of Chemical Forces on Physical Properties
Week 6  Defects in Ceramics
Week 7  Diffusion and Electrical Conductivity
Week 8  Mechanical Properties: Fast Fracture
Week 9  Thermal Properties
Week 10 Magnetic and Dielectric Properties
Week 11 Optical Properties
Week 12 Processing of Ceramics
Week 13 Structure of Glass
Week 14 Properties of Glass

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up
for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each
case, at least 1 week notice will be given.

Assessment and Evaluation:
Knowledge of ceramic structures and properties will be evaluated through four tests and an optional final
exam.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Test 1 (18%) {Week 3}
Test 2 (18%) {Week 6}
Test 3 (18%) {Week 9}
Test 4 (18%) {Week 12}
Final Exam (28%)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused
and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07 .

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential
to complete the course successfully. University rules related to excused and unexcused absences are located
on-line at http://student-rules.tamu.edu/rule07 . Please come on time. Silence cell phones and other
electronic distractions,
Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07 ). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      c) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      d) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

Academic Integrity:
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MSEN 460, Properties of Functional Materials  
Credits 3. 3 Lecture Hours  

Term: Fall 2017  

Meeting times and locations: TBD  

Instructor Information:  
Dr. Pao-Tai Lin; WEB 214F, paolin@tamu.edu, 979-458-8223  

**Course (catalog) description:** Origins of functional materials properties from their electronic and molecular structure; electron theory in solids; electronic transport and dielectric behavior; optical and magnetic properties; current applications of functional materials.  

**Course Prerequisites:** MSEN 220, MSEN 310; MSEN 222, AERO 413, BMEN 343, CHEN 313, CVEN 306, ENTC 206, or NUEN 265, or approval of instructor  

**Learning Outcomes:** At the end of this course, students should be able to:  
1. **Describe the origins of electronic bands in crystalline solids.** Compare and contrast linear combination of atomic orbitals and nearly free electron models of attaining electronic bands.  
2. **Predict electronic transport properties of semiconductors and metals from their band diagrams.** Relate effective mass of holes and electrons to band curvature. Calculate density of states and occupation near the Fermi energy. Apply knowledge of band diagrams to design materials with desired transport properties.  
3. **Relate ferroelectric and piezoelectric properties in crystals to their crystal structure.** Calculate electric dipoles from crystal structures. State symmetry conditions which allow for piezoelectric and ferroelectric behavior.  
4. **Predict optical properties of semiconductors and metals from their band diagrams.** Calculate the optical bandgap and optical absorption in a material. Differentiate direct and indirect bandgap semiconductors. Using the principles of bandgap engineering, design a material with desired optical properties.  
5. **Describe the magnetic behavior of atoms and electrons.** Differentiate the different types of magnetic behavior (diamagnetic, paramagnetic, ferromagnetic, antiferromagnetic, ferromagnetic) and the origin of each. Calculate atomic magnetic moments.  
6. **Describe the origin of ferromagnetic behavior and the processes that occur during magnetization of a material.** Relate magnetic hysteresis to domain growth and rotation.  

**Textbook:** Principles of Electronic Materials and Devices, S.O. Kasap.  

**Additional Material:** Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at [http://ecampus.tamu.edu](http://ecampus.tamu.edu).  

**Course Outline:**  
**Week 1** Classical electronic transport (metals)  
**Week 2** Quantum picture of electronic solids  
**Week 3** Quantum applications in materials  
**Week 4** Electronic bands (LCAO/Bloch functions)
Week 5  Phonons: Thermal Conductivity & heat capacity  
Week 6  Semiconductors and Interfaces  
Week 7  Dielectrics and Insulators  
Week 8  Piezoelectrics, Ferroelectrics, Pyroelectrics  
Week 9  Atomic and Macroscopic Magnetization  
Week 10  Collective Magnetic behavior of Materials  
Week 11  Ferromagnetic Domains, Magnetic Hysteresis  
Week 12  Optical: Transmission, reflection, absorption, scattering  
Week 13  Optical materials & devices  
Week 14  Superconductors

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Understanding of structure-property relationships will be evaluated through both conceptual questions and numerical problems in which relevant physical quantities will be calculated from fundamental relationships. Homework assignments and quizzes will play important roles in gaining a mastery of the course material.

Grading Scale (Standard Letter Scale):
A = 90-100  
B = 80-89.99  
C = 70-79.99  
D = 60-69.99  
F = <60

Grading Policies:
Exam#1 (20 %) {Week 4}  
Exam#2 (20 %) {Week 8}  
Exam#3 (20 %) {Week 15}  
Quizzes (5 %)  
In-Class Participation (5%)  
Homework (30 %) {Weekly}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.
**Make-up Policy:**

If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at [https://studentactivities.tamu.edu/app/sponsauth/index](https://studentactivities.tamu.edu/app/sponsauth/index)
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at [http://attendance.tamu.edu](http://attendance.tamu.edu) or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**

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Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
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MSEN 462, Advanced Materials Characterization
Credits 3. 2 Lecture Hours, 3 Laboratory Hours.

Term: Fall 2017
Meeting times and locations: TBD

Instructor Information:
Dr. Patrick Shamberger, Reed McDonald Bldg. 229, patrick.shamberger@tamu.edu, 979-458-1086

Course (catalog) description: Principles and techniques used in characterization of different materials, including metals, ceramics, polymers, composites, and semiconductor systems; microstructural, chemical/compositional, and surface analysis methods; interpretation and analysis of the characterization results.

Course Prerequisites: MSEN 220, MSEN 250, MSEN 310; or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
1. Grasp the principles and theory behind advanced materials characterization techniques;
2. Understand the instrumentation requirement, set-up, and performance capabilities and limitations of these materials characterization techniques;
3. Select appropriate method for structural, microstructural, chemical and surface analysis of different materials;
4. Interpret and analyze results from advanced materials characterization techniques;
5. Present and effectively communicate results of materials characterization.

Textbook:

Additional Material:
Yang Leng, Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, 2nd Ed., Willey, 2013

Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Week 1 X-Ray Diffraction and Scattering and Neutron Diffraction and Scattering with lab demonstrations;
Week 2 Optical Microscopy (OM) and Scanning Electron Microscopy (SEM)
Week 3 Transmission Electron Microscopy (TEM)
Week 4 Atomic Force Microscopy (AFM)/Scanning Probe Microscopy (SPM)
Week 5 Microanalysis in Electron Microscopy: Energy/Wavelength Dispersive Spectroscopy (EDS/WDS); Electron Backscatter Diffraction (EBSD); Electron Energy Loss Spectroscopy (EELS)
Week 6  OM, SEM, TEM, AFM, EDS, EBSD, and EELS lab demonstrations;
Week 7  Mid-term exam
        Chemical Analysis of Surface Composition: X-Ray Fluorescence (XRF); X-Ray and
        Ultraviolet Photoelectron Spectroscopy (XPS/UPS)
Week 8  Auger Electron Spectroscopy (AES); Secondary Ion Mass Spectrometry (SIMS)
Week 9  Photoluminescence (PL), Absorption/Transmission Spectroscopies; Visible and Near-IR
        Spectroscopy
Week 10 Fourier Transform Infrared Spectroscopy (FTIR); Raman Spectroscopy
Week 11 Lab demonstration of spectroscopy methods
Week 12 Mass Spectrometry (MS) with lab demonstration
Week 13 Nuclear Magnetic Resonance Spectroscopy (NMR) with lab demonstration
Week 14 Project presentations

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up
for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each
case, at least 1 week notice will be given.

Assessment and Evaluation:
Progress towards achieving learning outcomes will be evaluated through homework, exams, and final
project. Peer review will be incorporated into the evaluation of final project reports and presentations.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Mid-semester exam (25%) {Week 7}
Final Exam (25%) {Week 15}
Project presentation and report (20%) {Week 14}
Homework assignments (30%) {Weekly}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused
and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07 .

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential
to complete the course successfully. University rules related to excused and unexcused absences are located
on-line at http://student-rules.tamu.edu/rule07 . Please come on time. Silence cell phones and other
electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz,
exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed
upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

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2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
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      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
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7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student’s physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
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MSEN 472, Atomistic Simulation of Materials  
Credits 3. 3 Lecture Hours  

Stacked with MSEN 670  
Term: Fall 2017  

Meeting times and locations: TBD  

Instructor Information:  
Dr. Xiaofeng Qian, Reed McDonald Bldg. 226, feng@tamu.edu, 979-458-9843  

Course (catalog) description: Modern methods of computational modeling and simulation of materials properties and phenomena at the atomistic scale; quantum, classical, and statistical mechanical methods, including semi-empirical atomic and molecular-scale simulations, and other modeling techniques using macroscopic input.  

Course Prerequisites: MSEN 370; or approval of instructor.  

Learning Outcomes: At the end of this course, students should be able to:  
1. Differentiate the fidelity and assumptions of different scales of atomistic simulations,  
2. Apply quantum mechanical methods, classical methods based on empirical potentials, and continuum methods to describe different fundamental materials problems,  
3. Describe weaknesses and strengths of different scale simulation methods.  

Textbook: None.  

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.  

Course Outline:  
Week 1  Introduction to Modeling in Materials  
Week 2-4  Quantum Mechanical Methods  
Week 5-8  Interaction Potentials for Materials  
Week 9-12  Classical Simulation Methods  
Week 13-14  Continuum Methods  

Course Policies and Procedures:  
Changes in schedule:  
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.  

Assessment and Evaluation:  
Knowledge of application and theory of atomistic simulation will be demonstrated through homework sets, and through a final term project.
Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Class Participation (10%)  
Homework sets (40%) {Weekly}  
Term Project (50%) {Week 14}  

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at https://studentactivities.tamu.edu/app/sponsauth/index
2. Death or major illness in a student’s immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student’s presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
b) Confirmation of visit to a health care professional affirming date and time of visit.

7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**Academic Integrity:**
Aggie Honor Code: "An Aggie does not lie, cheat, or steal or tolerate those who do." For additional information please visit: http://aggiehonor.tamu.edu.

**Americans with Disabilities Act (ADA) Policy Statement:**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.
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MSEN 474, Materials Modeling of Phase Transformation and Microstructural Evolution
Credits 3. 2 Lecture Hours, 3 Lab Hours

Stacked with MSEN 619
Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Amine Benzeraga, HRBB 736C, benzeraga@tamu.edu, 979.845.1602

Course (catalog) description: Computer modeling and simulation of microstructural evolution during various phase transformation processes in solid materials, including spinodal decomposition, ordering, martensitic transformation, ferroelectric and ferromagnetic domain evolution, nucleation, growth, solidification.

Course Prerequisites: MSEN 370, or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:

1. Apply basic concepts of thermodynamics and kinetics of heterogeneous systems to the understanding of microstructure evolution of materials
2. Understand the basic principles behind diffuse interface modeling framework
3. Apply variational principles to arrive at kinetic evolution equations from functional thermodynamic descriptions
4. Use FiPy as the computational framework to implement phase field modeling of microstructures
5. Use basic numerical methods to implement solutions to the Cahn-Hilliard and Allen-Cahn equations

Textbook: Course Notes by Instructors

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:

Week 1  Thermodynamics of Microstructures
Week 2  Functions and functionals and Variational Calculus
Week 3  Sharp vs Diffuse Interface
Week 4  The Cahn-Hilliard Equation
Week 5  The Allen-Cahn Equation
Week 6  Phase-field Models
Week 7  Phase-field Models: the structure of interfaces
Week 8-9  Application of Phase Field Modeling to Solidification
Week 10-12  Application of Phase Field Modeling to Solid-Solid Phase Transformations
Week 13  The problem of nucleation
Week 14  Multi-physics Phase Field Modeling
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course will be evaluated through quizzes and projects.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Quizzes: 20% \( \{Weekly\} \)
Project 1: 20% \( \{Week 5\} \)
Project 2: 25% \( \{Week 9\} \)
Project 3: 35% \( \{Week 14\} \)

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer's discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

Attendance:
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Make-up Policy:
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The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

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2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation.

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

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MSEN 476, Multi-Scale Computational Materials Science
Credits 3. 2 Lecture Hours, 3 Lab Hours

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Dimitris Lagoudas, HRBB 109C, d-lagoudas@tamu.edu, 979.845.1604

Course (catalog) description: This is a problem-based advanced course illustrating elements of the challenges associated with multi-scale simulations in materials science. As an example, the course will examine the multi-scale modeling of elastic response of a multi-phase microstructure. Elements of uncertainty quantification and propagation will be central to the course.

Course Prerequisites: MSEN 370, or approval of instructor.

Learning Outcomes: At the end of this course, students should be able to:
1. Recognize the strengths and limitations associated with different computational materials modeling techniques
2. Recognize the challenges associated with simulation of materials systems across multiple scales in space and time
3. Understand basic concepts of model uncertainty
4. Apply of simple methods for uncertainty quantification and propagation to multi-scale materials problems
5. Implement practical schemes for information passing across two simulation scales

Textbook: None.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:

Week 1  The problem: Elastic Response of a Multi-phase Microstructure
Week 2  Models, Reality and Uncertainty
Week 3  Model Sensitivity and Model Validation
Week 4  Elements of Quantification of Uncertainty
Week 5  The Problem: From Electronic Structure to Elastic Properties of Materials
Week 6  Sampling Methods – Monte Carlo Methods
Week 7  The Problem: Using Molecular Dynamics to Predict Elastic Properties of Materials
Week 8  Elements of Parameter Estimation
Week 9  The Problem: Predicting Elastic Response of Multi-phase Microstructure
Week 10  Micromechanics
Week 11  Homogenization methods
Week 12  Multi-scale Models and Loss of Information
Week 13  Uncertainty Quantification in Multi-scale Computational Materials Science
Week 14  Uncertainty Propagation in Multi-scale Computational Materials Science
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course will be evaluated through quizzes and projects.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Quizzes: 20% {Weekly}
Project 1: 20% {Week 4}
Project 2: 25% {Week 9}
Project 3: 35% {Week 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer's discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.
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3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
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   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor's discretion), within one week of the last date of the absence:
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      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation

In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

Academic Integrity:
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MSEN 480, Communicating Materials Science and Engineering
1 Credit, c Course

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Ted Hartwig, Reed McDonald Bldg. 220, thartwig@tamu.edu, 979-845-1585

Course (catalog) description: Effective communication of technical topics in materials science and engineering to technical and non-technical audiences; emphasis on oral and visual presentations.

Course Prerequisites: MSEN 401 or registration therein.

Learning Outcomes: At the end of this course, students should be able to:
1. Prepare a technical abstract describing a short seminar.
2. Communicate technical results in report form in either a letter or e-mail.
3. Develop a clear and informative figure visually displaying quantitative information
4. Present a brief, no visual-aids technology ‘pitch’.
5. Effectively communicate an important concept in the field of materials science to a non-technical audience.
6. Deliver a 10-minute technical presentation to an audience of your peers.
7. Assemble and present a technical poster to an audience of your peers.


Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://evampus.tamu.edu.

Course Outline:
Week 1 Course Introduction/Communication Mechanics
Week 2 The ‘Pitch’: pt 1
Week 3 The ‘Pitch’: pt 2
Week 4 The Abstract
Week 5 Non-technical Presentations: Grabbing Attention
Week 6 Non-technical Presentations: Explaining Complicated Ideas Simply
Week 7 Technical Oral Presentations: Intro/Background
Week 8 Technical Oral Presentations: Data/Results
Week 9 Technical Oral Presentations: Takeaway Points
Week 10 Posters: Layout
Week 11 Posters: The Figure
Week 12 Posters: Content
Week 13 Presenting Technical Posters
Week 14 Presenting through video
Course Policies and Procedures:

Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
Effective communication techniques will be evaluated through oral, written, and visual presentations. Peer evaluation, and continued revision and improvement of first draft materials will play important roles in gaining a mastery of the course material. This course is a formal communication course. Thus, 1 crh (100% of grade) will be based on form, content, and style of student presentations.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

Grading Policies:
Technology ‘pitch’ (10%) {Week 3}
Abstract (10%) {Week 5}
Non-technical Presentations (20%) {Week 6}
Technical Presentations (20%) {Week 9}
Figure (10%) {Week 12}
Poster Presentations (20%) {Week 13}
Video Presentations (10%) {Week 14}

Course will not be graded on a curve. Extra credit opportunities may be provided at the lecturer’s discretion.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07. Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details http://student-rules.tamu.edu/rule07). The fact that these are university
-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

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2. Death or major illness in a student’s immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student’s presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at http://attendance.tamu.edu or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
9. Mandatory participation as a student-athlete in NCAA-sanctioned competition.
10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student’s physician. Requests for excused absence related to pregnancy should be directed to the instructor.

Other absences may be excused at the discretion of the instructor with prior notification and proper documentation. In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

Academic Integrity:
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MSEN 484, Internship
Credits 0-4.

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Michael J. Demkowicz, Reed McDonald Bldg. 231, 979.845.0750

Course (catalog) description: Practical experience working in a professional materials science and engineering setting offered on an individual basis.

Course Prerequisites: Junior or Senior classification, approval of instructor

Learning Outcomes: At the end of this course, students should be able to:
1. Formulate and solve engineering problems,
2. Function on multi-disciplinary teams,
3. Act in a professional and ethical manner,
4. Communicate effectively, and
5. Apply synthesis, characterization, or simulation methods towards solving complex materials-related challenges.

Textbook: none.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
None.

Course Policies and Procedures:
Assessment and Evaluation:
Internships will be completed or a Satisfactory/Unsatisfactory basis only. Satisfactory grade requires completion of reflection assignment at the internship midpoint and at the conclusion of the internship, as well as favorable employer feedback at the end of the internship. The student is responsible for soliciting a letter of evaluation at the end of the internship.

Grading Scale (Standard Letter Scale):
S = Satisfactory
U = Unsatisfactory

Grading Policies:
Satisfactory grade requires completion of reflection assignment at the beginning, midpoint and at the conclusion of the internship, as well as a favorable letter from supervisor at the completion of the internship.
Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at http://student-rules.tamu.edu/rule07.

Attendance:
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10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.

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In cases where prior notification is not feasible (e.g., accident or emergency) the student must provide notification by the end of the second working day after the absence, including an explanation of why notice could not be sent prior to the class.

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This page intentionally blank
MSEN 485, Directed Studies
Credits 0-4.

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Patrick Shamberger, Reed McDonald Bldg. 229, patrick.shamberger@tamu.edu, 979-458-1086

Course (catalog) description: Directed study of selected problems in the area of materials science and engineering not covered in other courses. May be taken four times for credit.

Course Prerequisites: Junior or Senior classification, approval of instructor

Learning Outcomes: At the end of this course, students should be able to demonstrate conceptual understanding in the topic area of directed study, as defined by the instructor. Learning outcomes are identified on an individual basis at the outset of the semester.

Textbook: Textbook identified on an individual basis at the outset of the semester.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Course outline identified on an individual basis at the outset of the semester.

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course is evaluated based on submission of directed-study related products, as agreed upon by the student and the faculty instructor at the beginning of the semester. The student is responsible for preparing, and getting instructor approval for the course plan of study, including: 1) Objective of the Directed Studies course, 2) Approach, 3) Expected Outcomes/Deliverables, 4) Weekly Schedule, 5) Grading scheme, and 6) Credit Hour justification.

Grading Scale (Standard Letter Scale):
A = 90-100
B = 80-89.99
C = 70-79.99
D = 60-69.99
F = <60

179
Grading Policies:
Grading scheme is agreed upon by the student and faculty instructor at the onset of the semester.

Late Work Policy:
No late work will be accepted, unless in the case of excused attendance. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07).

Attendance:
The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07). Please come on time. Silence cell phones and other electronic distractions.

Make-up Policy:
If an absence is excused, the instructor will either provide the student an opportunity to make up any quiz, exam or other work that contributes to the final grade or provide a satisfactory alternative by a date agreed upon by the student and instructor. If the instructor has a regularly scheduled make up exam, students are expected to attend unless they have a university-approved excuse. The make-up work must be completed in a timeframe not to exceed 30 calendar days from the last day of the initial absence.

The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for the absence. Among the reasons absences are considered excused by the university are the following (see Student Rule 7 for details [http://student-rules.tamu.edu/rule07](http://student-rules.tamu.edu/rule07)). The fact that these are university-excused absences does not relieve the student of responsibility for prior notification and documentation. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code.

1. Participation in an activity that is required for a class and appears on the university authorized activity list at [https://studentactivities.tamu.edu/app/sponsauth/index](https://studentactivities.tamu.edu/app/sponsauth/index)
2. Death or major illness in a student's immediate family.
3. Illness of a dependent family member.
4. Participation in legal proceedings or administrative procedures that require a student's presence.
5. Religious holy day. NOTE: Prior notification is NOT required.
6. Injury or illness that is too severe or contagious for the student to attend class.
   i. Injury or illness of three or more class days: Student will provide a medical confirmation note from his or her medical provider within one week of the last date of the absence (see Student Rules 7.1.6.1)
   ii. Injury or illness of less than three class days: Student will provide one or both of these (at instructor’s discretion), within one week of the last date of the absence:
      a) Texas A&M University Explanatory Statement for Absence from Class form available at [http://attendance.tamu.edu](http://attendance.tamu.edu) or
      b) Confirmation of visit to a health care professional affirming date and time of visit.
7. Required participation in military duties.
8. Mandatory admission interviews for professional or graduate school that cannot be rescheduled.
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10. In accordance with Title IX of the Educational Amendments of 1972, Texas A&M University shall treat pregnancy (childbirth, false pregnancy, termination of pregnancy and recovery therefrom) and related conditions as a justification for an excused absence for so long a period of time as is deemed medically necessary by the student's physician. Requests for excused absence related to pregnancy should be directed to the instructor.
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MSEN 491, Research
Credits 0-4.

Term: Fall 2017

Meeting times and locations: TBD

Instructor Information:
Dr. Patrick Shamberger; Reed McDonald Bldg. 229, patrick.shamberger@tamu.edu, 979-458-1086

Course (catalog) description: Research conducted under the direction of faculty members in materials science and engineering. May be taken four times for credit.

Course Prerequisites: Approval of instructor

Learning Outcomes: At the end of this course, students should have made significant research progress in the agreed upon area of research, as defined by the instructor. Learning outcomes are identified on an individual basis at the outset of the semester.

Textbook: Textbook identified on an individual basis at the outset of the semester.

Additional Material: Lecture notes, assignments, solutions, grades, project instructions, and additional material will be available at http://ecampus.tamu.edu.

Course Outline:
Course outline identified on an individual basis at the outset of the semester.

Course Policies and Procedures:
Changes in schedule:
The instructor reserves the right to change the order and content of lectures as necessary (and to make up for holidays and unscheduled class cancellations). Exam dates may be changed by the instructor, but in each case, at least 1 week notice will be given.

Assessment and Evaluation:
The course is evaluated based on submission of research-related products, as agreed upon by the student and the faculty instructor at the beginning of the semester. The student is responsible for preparing, and getting instructor approval for the course plan of study, including: 1) Objective of the Research, 2) Approach, 3) Expected Outcomes/Deliverables, 4) Weekly Schedule, 5) Grading scheme, and 6) Credit Hour justification.

Grading Scale (Standard Letter Scale):
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3. Illness of a dependent family member.
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TEXAS A&M UNIVERSITY
AT QATAR
TAMUQ

CHANGE IN COURSES
Texas A&M University  
Departmental Request for a Change in Course  
Undergraduate • Graduate • Professional  
• Submit original form and attachments •  

Form Instructions:  
1. Course request type:  
   ☑ Undergraduate ☐ Graduate ☐ First Professional (DDS, MD, JD, PharmD, DVM)  
2. Request submitted by (Department or Program Name): Texas A&M University at Qatar-Petroleum Engineering  
3. Course prefix, number and complete title of course: PETE 336 Petroleum Technical Presentation I  

4. Change requested:  
   a. Prerequisite(s): From: _____________________________ To: _____________________________  
   c. Cross-list with:  
      Consolidated courses require the signatures of both department heads.  
   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.  
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. Attach a course syllabus.  

5. Is this an existing core curriculum course? ☑ Yes ☐ No  
6. If grade type is changing for existing course, indicate the new grade type: ☑ Grade ☐ S/U ☐ P/F (CMD)  
7. If this course will be stacked, please indicate the course number of the stacked course: ☑ Yes ☐ No  
   I verify that I have reviewed the FAQ for Export Control Basics for Distance Education (http://vpr.tamu.edu/resources/export-control/basics-for-distance-education)  

9. Complete current course title and current catalog course description:  
   Preparation of a written technical paper on a subject related to petroleum technology and an oral presentation of the paper in a formal technical conference format; oral presentations judged by petroleum industry professionals.  
   Prerequisites: ENGL 210; junior or senior classification, petroleum engineering majors only; or approval of department head.  

10. Complete proposed course title and proposed catalog course description (not to exceed 50 words):  
    Preparation of a written technical paper on a subject related to petroleum technology. Prerequisites: ENGL 210; junior or senior classification, petroleum engineering majors only; or approval of department head.  

   a. As currently in course inventory:  
      | Prefix | Course # | Title (excluding pronunciation) |
      | PETE   | 336      | Petroleum Technical Present I  |
      |        | 0.00     | 3.00                           |

   b. Change to:  
      | Prefix | Course # | Title (excluding pronunciation) |
      |        |          |                                |

   Approval recommended by:  
   Dr. Michael Bowman  
   Department Head or Program Chair (Type Name & Sign)  
   Date  
   Chair, College Review Committee  
   Date  
   Dean of College  
   Date  
   Submitted to Coordinating Board by:  
   Chair, GC or UCC  
   Date  
   Effective Date  

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu  
Curricular Services • 08/14
Texas A&M University  
Departmental Request for a Change in Course 
Undergraduate • Graduate • Professional  
- Submit original form and attachments -

Form Instructions
1. Course request type:  
   ✓ Undergraduate  □ Graduate  □ First Professional (DDS, MD, JD, PharmD, DVM)
2. Request submitted by (Department or Program Name): Texas A&M University at Qatar: Petroleum Engineering
3. Course prefix, number and complete title of course: PETE 436 Petroleum Technical Presentation II

4. Change requested  
   a. Prerequisite(s): From: To:  
   b. Withdrawal (reason):  
   c. Cross-list with:  
   Cross-listed courses require the signature of both department heads.
   d. Change in course title and description. Enter complete current course title and current course description in item 9; enter proposed course title and proposed course description in item 10. Complete item 11a and b for a change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 11a and b. Attach a course syllabus.

5. Is this an existing core curriculum course?  
   □ Yes  ✓ No

6. If grade type is changing for existing course, indicate the new grade type:  
   □ Grade  □ S/U  □ P/F (CLM)

7. If this course will be stacked, please indicate the number of the stacked course:  
   □ I verify that I have reviewed the FAQ for Export Control Basics for Distance Education ([http://vpr.tamu.edu/resources/export-controls/controls-basics-for-distance-education](http://vpr.tamu.edu/resources/export-controls/controls-basics-for-distance-education))

8. Complete current course title and current catalog course description:  
   PETE 436 Petroleum Technical Presentations II. (0-3) Credit 1. 
   Preparation of a written technical paper on a subject related to petroleum technology and an oral presentation of the paper in a formal technical conference format; oral presentations judged by petroleum professionals at the departmental student paper contest held during the same academic year. Prerequisites: PETE 336; senior classification, petroleum engineering majors only, or approval of department head.

9. Complete proposed course title and proposed catalog course description (not to exceed 50 words):  
   PETE 436 Petroleum Technical Presentations II. (0-3) Credit 1. 
   Preparation of a written technical paper on a subject related to petroleum technology and an oral presentation of the paper in a formal technical conference format. Prerequisites: PETE 336; senior classification, petroleum engineering majors only, or approval of department head.

10. As currently in course inventory:  

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Course #</th>
<th>Title (excluding punctuation)</th>
<th>Lect</th>
<th>Lab</th>
<th>Other</th>
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<th>CIP and Fund Code</th>
<th>Admin Unit</th>
<th>EICE Code</th>
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b. Change to:

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Course #</th>
<th>Title (excluding punctuation)</th>
<th>Lect</th>
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<th>Level</th>
</tr>
</thead>
</table>

Approval recommended by:  
Dr. Michael Bowman

Department Head or Program Chair (Type Name & Sign)  
Date  
Chair, College Review Committee  
Date  
Dean of College  
Date  
Chair, GC or UCC  
Date  
Associate Director, Curricular Services  
Date  
Effective Date  

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra.williams@tamu.edu Curricular Services - 08/14
TAMUQ
CHANGE IN CURRICULUM

TEXAS A&M UNIVERSITY AT QATAR
PETROLEUM ENGINEERING
B.S. IN PETROLEUM ENGINEERING
Texas A&M University
Request for a Change in Curriculum
Undergraduate • Graduate • Professional

1. Program request type: ☑ Undergraduate □ Graduate □ First Professional (e.g., DVM, JD, MD, etc.)

2. Request change for: ☑ Degree Program □ Minor □ Certificate

3. Request submitted by (Department or Program Name): Texas A&M University at Qatar Petroleum Engineering

Program Designation and Name
(e.g., B.A. in History, Minor in History, Certificate in European Union): B.S. in Petroleum Engineering

4. Brief description of change:
PETE 437 added so students can register for their Student Paper Contest degree requirement which has been eliminated from PETE 436. PETE 300 (internship requirement) moved form degree evaluation additional requirements to detailed requirements in the degree evaluation (see attached). PETE 300 and PETE 437 are zero credit courses.

5. Rationale for change:
To keep align with the main campus PETE B.S. degree plan.

Use the checkboxes below to make sure that all information is included.

7. a. Proposed curriculum attached. □ Yes ☑ No

b. Current catalog curriculum with handwritten edits attached. ☑ Yes □ No

c. Current Howdy degree evaluation with handwritten edits attached. ☑ Yes □ No

Please make sure the attached proposed curriculum, catalog and Howdy degree evaluation match.

8. a. Will degree program hours change (increase/decrease) due to the proposed curriculum changes? □ Yes ☑ No

b. If yes, degree program hours will change from: _______ to: _______

c. If yes, is the Texas Higher Education Coordinating Board form attached? http://www.cheb.state.tx.us/index.cfm?objectid=A0F89F7A-9A92-4F11-2756AD3BBF01D60

9. If proposed changes affect other unit(s), are letters of support attached? □ Yes ☑ No

IMPORTANT NOTE: Curriculum changes submitted through the approval process and fully approved by February (December-UCC/GC, January-Faculty Senate, February-President) will be effective in the next academic year. Changes requiring approval beyond the University should complete the internal approval process early in the fall semester whenever possible in order to ensure timely implementation.

Approval recommended by:
Dr. Michael Bowman
Department Head or Program Chair (Type Name & Sign) Date Dean of College Date

Chair, College Review Committee Date Chair, GC or UCC Date

Questions regarding this form should be directed to Curricular Services at 845-8201 or curricular@tamu.edu
Curricular Services – 16/14
**Detail Requirements**

Information for Degree Evaluation

This is NOT an official evaluation.

**Program Evaluation**

Limitation: Correspondence: No more than 12 hours of correspondence earned through an accredited institution may be used for an undergraduate degree.

Limitation: Combination: Maximum combination of 18 hours of 481, 482, 483, and/or 491 courses may be used for an undergraduate degree.

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<table>
<thead>
<tr>
<th>Program :</th>
<th>Catalog Term :</th>
<th>Fall 2015 - Qatar</th>
</tr>
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<tr>
<td>[QT] 85 PETE</td>
<td>Evaluation Term :</td>
<td>Fall 2015 - College Suison</td>
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<tr>
<td>Campus :</td>
<td>College :</td>
<td>Qatar Campus</td>
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**Program GPA :**

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**Other Course Information**

**Transfer :**

| 0.000 | 0 |

This is NOT an official evaluation.

---

**Area Supporting Coursework (56.000 credits) - Not Met :**

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Must make a grade of 'C' or better.

| No AND | S. | GEOL 404 | | |

**Total Credits and GPA**

| 0.000 | .30 |

unofficial evaluation
<table>
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Total Credits and GPA 0.000 39

unofficial evaluation

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Total Credits and GPA 0.000 09

unofficial evaluation

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unofficial evaluation

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Total Credits and GPA 0.000 00

unofficial evaluation

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<th>Area</th>
<th>Language, Philosophy &amp; Culture (3.000 credits) - Not Met</th>
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Total Credits and GPA 0.000 00
unofficial evaluation

**Area: Creative Arts (3.000 credits) - Not Met**

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<tbody>
<tr>
<td>No</td>
<td>A.</td>
<td>Creative Arts Requirement</td>
<td>Select three hours from any course with the Creative Arts attribute [WCA].</td>
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**Total Credits and GPA:** 0.000 \(\cdot\) 0.00

unofficial evaluation

**Area: Social and Behavioral Sciences (3.000 credits) - Not Met**

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<tr>
<td>No</td>
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<td>Social Science Rqmt 3hrs</td>
<td>Select from courses with the Social and Behavioral Science attribute [KSSC].</td>
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**Total Credits and GPA:** 0.000 \(\cdot\) 0.00

unofficial evaluation

**Area: Citizenship (12.000 credits) - Not Met**

**Description:** Completion of 4 semesters of Upper-Level ROTC may be substituted for 3 hours of American History and 3 hours of Political Science.

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<tr>
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<th>Condition</th>
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<th>Subject</th>
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<td>No</td>
<td>AND</td>
<td>B.</td>
<td>Political Science Rqmt 6hrs</td>
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Take POLS 206 and POLS 207.

**Total Credits and GPA:** 0.000 \(\cdot\) 0.00

unofficial evaluation

**Area: Work Not Applied - Met**

**Description:** See advisor for acceptable substitutions.

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<th>Attribute</th>
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**Total Credits and GPA:** 0.000 \(\cdot\) 0.00

unofficial evaluation

**Area: University Writing Requirement - Not Met**

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<th>Credits</th>
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<tbody>
<tr>
<td>No</td>
<td>A.</td>
<td>Writing Requirement</td>
<td>Two courses required. Only sections of ENGR 482, PETE 310-311, 335, 336, 435, 436 with the Writing attribute [UWRT] may be used to satisfy this requirement.</td>
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**Total Credits and GPA:** 0.000 \(\cdot\) 0.00
### Area: Int'l & Cult Diversity - Not Met

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<th>Subject Attribute</th>
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<tbody>
<tr>
<td></td>
<td>A.</td>
<td>Int'l &amp; Cultural Diversity 6hr</td>
<td>Select from courses with the International and Cultural Diversity attribute (URC0) (except sections of BUSN 289 with the UWRT attribute).</td>
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### Area: Foreign Language - Not Met

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<tbody>
<tr>
<td></td>
<td>A.</td>
<td>Foreign Language Reqnt</td>
<td>Complete one of the following: 1. Two years of the same foreign language in High School. 2. A two semester sequence of the same foreign language for University credit.</td>
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### Area: GPR-Major - Not Met

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<tr>
<td></td>
<td>A.</td>
<td>GPR-Major 52+hrs</td>
<td>Select from PETE 160-499; CHEM 459, 461; ECE 215, 303, 314; GEOL 104, 312, 404; GEOP 421; MATH 304. Must maintain a GPA of 2.000 in all courses taken.</td>
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### Area: Residence Requirement - Not Met

**Description:** A minimum of 36 hours of 300-400 level coursework must be completed at Texas A&M University. 12 hours must be in the major field.

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<td>Residence-Major 12hrs</td>
<td>Select from PETE 300-499; GEOL 312, 404, GEOP 421.</td>
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<td>Residence 300-499 24hrs</td>
<td>Select any courses level 300-499.</td>
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unofficial evaluation

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Additional Information

Information for Degree Evaluation

Program: [QT] BS PETE

**Program Non-Course Requirements – Not Met**

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**Program Restricted Grades**

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**Program Restricted Subjects and Attributes**

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Print
**SOPHOMORE YEAR**

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<td>ENGL 210 Sc. and Tech. Writing ..................</td>
<td>CYEN 305 Mechanics of Materials ..................</td>
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<td>MATH 251 Engineering Mathematics III ..........</td>
<td>GEOL 104 Physical Geology .........................</td>
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<td>MEEN 221 Statics and Particle Dynamics ..........</td>
<td>MATH 308 Differential Equations ..................</td>
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<td>PETE 325 Petroleum Drilling Systems .............</td>
<td>MEEN 315 Prin. of Thermodynamics .................</td>
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**Junior Year**

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<td>PETE 310 Reservoir Fluids .......................</td>
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<td>PETE 314 Transport Processes in Petroleum Production</td>
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**Summer**

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**Senior Year**

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<td>PETE 404 Integrated Reservoir Modeling ..........</td>
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</table>

Total Credits Required: 128

**Notes:**

1. To be selected from the University Core Curriculum. Of the 18 hours shown, University Core Curriculum electives 3 must come from the visual and performing arts, 3 from social and behavioral sciences, 6 from U.S. history and 6 from COLS 206 and 207. The required hours from international and cultural diversity may be met by courses satisfying the visual and performing arts, social and behavioral sciences, and/or U.S. history requirements. If they are also on the approved list of international and cultural diversity courses (see academic advisor for more information). In addition, ENGR 412 must be taken.

2. Select from GEOL 312, GEOP 421, PETE 480, 412 or 416 or other as approved by the department head.