Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional
• Submit original form and attachments •

1. This request is submitted by the Department of ___________ AEROSPACE ENGINEERING - Mechanics and Materials ___________.

2. Course prefix, number and complete title of course: MEMA 626 - Mechanics of Active Materials

Attach a brief supporting statement for changes made to items 3a thru 3d, and 5 below.

3. Change requested
   a) Prerequisite(s): From _______________________________ To _______________________________
   b) Withdrawal (reason)
   c) Cross-list with ______ AERO 618 - Mechanics of Active Materials
      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; complete proposed course title and proposed course description in items 4 and 5.
   e) Change in credit/contact hours. Complete item 6b. Underscore change(s). Attach a course syllabus.

4. Complete current course title and current course description: Mechanics of Active Materials. Introduction to coupled field theories: constitutive response of materials with thermal and electromagnetic coupling; microstructural changes due to phase transformations; shape memory alloys; piezoelectric and magnetostrictive materials; active polymers and solutions. Micromechanics of active composites.

5. Complete proposed course title and proposed course description (not to exceed 50 words): Mechanics of Active Materials. Introduction to coupled field theories: constitutive response of materials with thermal and electromagnetic coupling; microstructural changes due to phase transformations; shape memory alloys; piezoelectric and magnetostrictive materials; active polymers and solutions. Micromechanics of active composites.

6. a) As currently in course inventory:

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b) Change to:

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Approval recommended by:

Head of Department: __________________________ Date: ____________
Head of Department (if cross-listed course): __________________________ Date: ____________

Chair, College Review Committee: __________________________ Date: ____________
Dean of College: __________________________ Date: ____________

Submitted to Coordinating Board by:

Dean of College: __________________________ Date: ____________

Questions regarding this form should be directed to Sandra Williams at 845-8836.
OAR/AS – 04/07
MEMA 626 / AERO 618
Mechanics of Active Materials
Credit 3: (3-0)

Instructor: James G. Boyd, HRBB 741C, 458-0419, jboyd@aero.tamu.edu
Spring 2008: Time TBA, Room TBA
Textbook: Non-Equilibrium Thermodynamics, deGroot and Mazuer
Prerequisites: MEMA 601 (Theory of Elasticity) or MEMA 602 (Continuum Mechanics)

Course Objectives: Introduction to coupled field theories; constitutive response of materials with
electromagnetic coupling; microstructural changes due to phase transformations; shape memory alloys;
active polymers and ionic solutions; electrodiffusion; multifunctional nanocomposites.

Each student will choose one type of active material for a detailed study.

Topics:
(1) Introduction; notation; review of kinematics, momentum, linear elasticity
(2) Coupled electro-mechanical field equations; piezoelectricity;
       Gauss law; boundary conditions; material symmetries.
(3) Piezoelectric structures and devices; transducers; vibration control
(4) Shape memory alloys; martensitic phase transformations
(5) Electroactive multifunctional nanocomposites
(6) Actuation, energy storage, and electrical power from polymer electrolyte/carbon electrode
       supercapacitors.

Grading:
   25% Homework
   25% Midterm Exam
   25% Final Exam
   25% Project

Makeup Exams: Makeup exams will be given only for excused absences as defined in the TAMU
Student Rules (http://student-rules.tamu.edu/part1.htm).

Electronic Noise: Pagers, telephones, watches, and all other electronic noise making devices are not
allowed to make noise during the lecture.

Outline

1. Introduction. Notation.  
   Hours
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   Conservation of charge.  
3. Fundamental definitions for electricity and magnetism.  
4. Maxwell’s equations with emphasis on low frequency conditions.  
5. Balance of linear and angular momentum.  
8. Thermodynamically reversible active materials:  
    A. Thermoelasticity  
    B. Piezoelectricity  
9. Thermodynamically irreversible active materials:  
    A. Shape memory alloys  
    B. Ionic diffusion materials:  
       1. Ionomeric polymer metal composites  
       2. Double-layer capacitors  
   Total 42
Americans with Disabilities Act
The Americans with Disabilities Act (ADA) is a federal antidiscrimination 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 the Department of Student Life, Services for Students with Disabilities in Room B118 Cain Hall, or call 845-1637.

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Scholastic Integrity
As commonly defined, plagiarism consists of passing off as one's own the ideas, work, writings, etc., that belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated. If you have questions regarding plagiarism, please consult the latest issue of the Texas A&M University Student Rules [http://student-rules.tamu.edu/], under the section "Scholastic Dishonesty."