



**Mechanical Engineering 530.606**  
**Mechanics of Solids and Materials II**  
**Spring, 2018 (3 credits)**

**Instructor**

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Office: Malone 117, 410-516-7257

Office hours: Wednesdays 3:00 – 4:00 PM, Malone 117, and by appointment.

Wednesday office hours will occasionally be cancelled.

**Teaching Assistant**

Jaiyu Liu

Office hours: Tuesdays, Thursdays 5:00 – 6:00 PM, Latrobe 216A

**Meetings**

Monday, Wednesday, 1:30–2:45 PM, Latrobe 107

**Textbooks**

[1]–[4] – Helpful references but not required. More will be given later when we discuss other topics. Note that [1] and [2] are available online through JHU libraries, [4] is available at [www.solidmechanics.org](http://www.solidmechanics.org).

[1] M. H. Sadd, *Elasticity: theory, applications, and numerics*. Academic Press, 2009.

[2] M. E. Gurtin, E. Fried, and L. Anand, *The mechanics and thermodynamics of continua*. Cambridge University Press, 2010.

[3] R. J. Atkin and N. Fox, *An introduction to the theory of elasticity*. Courier Corporation, 2013.

[4] A. F. Bower, *Applied mechanics of solids*. CRC press, 2009.

**Online Resources**

Use Blackboard for digital copy of schedule and some reading assignments. The schedule may be updated periodically to reflect progress.

**Course Description**

An overview of the area of the mechanics of solids and materials, with the intent of providing the foundation for graduate students interested in research that involves these disciplines. The course is based on the principles of continuum mechanics, and covers the fundamental concepts of elasticity, plasticity, and fracture as applied to materials. One objective is to get graduate students to the point that they can understand significant

fractions of research seminars and papers in this area. This mathematically rigorous course emphasizes the setup and solution of boundary value problems in mechanics, and attempts to integrate the primary behaviors with deformation and failure mechanisms in materials. Special topics covered may include (depending on the interests of the student body) wave propagation, viscoelasticity, geomechanics or biomechanics.

### Course Schedule (Subject to change)

Date	Topic	Remark
1/29	Review of tensors, kinematics, compatibility	
1/31	Kinematics, linearized kinematics, stress	HW 1 given
2/5	Non-Cartesian coordinates, sample problems	
2/7	Elasticity, balance laws, BVPs	HW 1 due, 2 given
2/12	BVPs, principle of minimum potential energy PMPE	
2/14	PMPE, Rayleigh-Ritz, other 2D and 3D solutions	HW 2 due, 3 given
2/19	Plane stress, plane strain, Airy's stress functions	
2/21	Plane stress, plane strain, Airy's stress functions	HW 3 due, 4 given
2/26	Torsion problems	
2/28	Torsion problems	HW 4 due, 5 given
3/5	3D BVPs: half space, Eshelby, contact	
3/7	3D BVPs: contact mechanics	
3/12	BVPs: Thermoelasticity, Review	HW 5 due
3/14	Midterm exam	
3/19-25	Spring Break	
3/26	Thermoelasticity	HW 6 given
3/28	Elastodynamics: bulk and surface waves	
4/2	Elastodynamics: stability, BVPs, special topics	
4/4	Class cancelled	
4/9	Review	HW 6 due, 7 given
4/11	Plasticity: Introduction, small strain, rate-independent	
4/16	Plasticity: Small strain, rate-independent, BVPs	
4/18	Plasticity: Finite strain plasticity, viscoplasticity	HW 7 due, 8 given
4/23	Plasticity: Crystal plasticity	
4/25	Fracture: Introduction, LEFM	HW 8 due, 9 given
4/30	Fracture: LEFM, J-integral, special topics.	
5/2	Special topics	HW 9 due

### Grading

Homework (50%), Midterm (25%), Final (25%). A portion of the final may be a critical review of a paper or a similar project.

### Collaboration Policy

You are encouraged to discuss solution strategies with other students, but you must find the solutions and write down answers to all questions on your own.

## **Ethics**

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any violations you witness to the instructor.

You can find more information about university misconduct policies on the web at these sites:

- For undergraduates: <http://e-catalog.jhu.edu/undergrad-students/student-life-policies/>
- For graduate students: <http://e-catalog.jhu.edu/grad-students/graduate-specific-policies/>

## **Students with Disabilities**

Any student with a disability who may need accommodations in this class must obtain an accommodation letter from Student Disability Services, 385 Garland, (410) 516-4720, [studentdisabilityservices@jhu.edu](mailto:studentdisabilityservices@jhu.edu) .