ME 309: Structural Mechanics – Spring 2020

Professor Douglas P. Holmes – *dpholmes@bu.edu*

Lecture - Four Credits
203 Photonics (PHO)
Tuesday & Thursday
9:00a.m. – 10:45a.m.

Office: 730 Commonwealth Ave., EMA 213
Phone: (617) 358-1294
Office Hours: Tues. 2:00p.m.– 4:00p.m.
Wed. 9:05a.m.– 9:55a.m.

Prerequisites: Mechanics of Materials
Textbook: *Advanced Mechanics of Materials and Applied Elasticity, 6^{th} Ed.,* A.C. Ugural, S.K. Fenster, Pearson Prentice Hall, 2019
Learning from Anywhere: *Synchronous* learning available at Zoom ID: 921 7672 7754 – **email me for Zoom password**
Asynchronous learning available via our YouTube Channel: https://tinyurl.com/y2ebfmy3
Office Hours at Zoom ID: 617 358 1294 – **same password as course password**

Course Description:
Application of solid mechanics to structures and machine elements. Elementary elasticity. Energy principles. Matrix and finite element methods. Stability phenomena. Modes of structural failure. Introduction to FEM. Includes design project.

Goals:
1. Be able to apply solid mechanics and elementary elasticity to structures.
2. Formulate analytical solutions to simple structures using equilibrium methods and energy principles.
3. Use numerical methods to predict deformation, stability, and failure of complex structures.

Course Schedule (Tentative):

Wk.	Dates	Subjects	Reading	Homework
1	Jan. 26, 28	Overview, strain energy, scalings	Review Article	
2	Feb. 2, 4	Energy, Stability, Castigliano's theorems	10.4, 10.5–10.8	HW 1
3	Feb. 9, 11	Virtual work, approximate solutions, Rayleigh–Ritz	10.9–10.11	HW 2
4	Feb. 18	Principle of Least Action, Variational Calculus		
5	Feb. 23, 25	Stress components, Equilibrium	1.1 – 1.7	
6	Mar. 2, 4	Stress Transformation, Principal Stress	1.8–1.16	HW 3
7	Mar. 9, **Mar. 11**	**Midterm Exam**		
8	Mar. 16	Strain, constitutive laws	2.1–2.5	
9	Mar. 23, 25	Axisymmetric problems	2.6–2.14	HW 4
10	Mar. 30, Apr. 1	Weak Forms		
11	Apr. 6, 8	Matrix analysis of structures I	7.8	HW 5
12	Apr. 13, 15	Matrix analysis of structures II		
13	Apr. 20, 22	Finite element method I	7.6–7.7, 7.9–7.10	HW 6
14	Apr. 27, 29	Finite element method II, *Review*		
		Final Exam – Take–Home Exam: Due May 6th		

Grading: There will be six homework assignments (20% total) and two exams (40% each).

Exceptions: Missed homework assignments and examinations will only be excused with *written permission from the Office of the Dean of the College of Engineering.* You will have a week upon return to complete the missed assignment. All complaints related to projects and exams must be reported to the instructor within one week after the grades are announced.

Academic Conduct & Student Performance:

1. **Academic Honesty:** In engineering, just as in humanities, science, and social science disciplines, plagiarism is unacceptable. Original thought is highly valued in engineering and is expected from students in this course in preparing and completing all course assignments. Students must follow the COE Academic Conduct Code: www.bu.edu/academics/eng/policies/academic-conduct/. Any violation of this conduct code will be reported to the COE Academic Conduct Committee.
2. **Working Together:** Students are permitted to consult with each other regarding approaches to solving problems in these assignments. If you consult with another person or webpage, please write "Consulted with <person's name> in preparing this assignment."
3. **COVID 19 & BU Community Health Expectations:** Masks are required and face coverings must be worn over the mouth and nose at all times when in public spaces on campus, including classrooms. Students should be prepared to show proof that they are compliant with health attestations and testing in order to attend class. All students are expected to follow all university guidelines with respect to daily symptom checks, testing, social distancing, and mask wearing when they leave their dorm or home. For a detailed description of official BU policies regarding COVID, please visit: http://www.bu.edu/dos/policies/lifebook/covid-19-policies-for-students/

4. **Mental Health:** Diminished mental health, including significant stress, mood changes, excessive worry, or problems with eating and/or sleeping can interfere with optimal academic performance. The source of symptoms might be strictly related to your course work; if so, please speak with me. However, problems with relationships, family worries, loss, or a personal struggle or crisis can also contribute to decreased academic performance. BU provides mental health services to support the academic success of students. Getting help is a smart and courageous thing to do – for yourself *and* for those who care about you.
5. **Inclusion:** I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.
6. **Financial Security:** Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Dean of Students for support. Please notify the professor if you are comfortable in doing so. This will enable me to provide any resources that I may possess.
7. **Accommodations for Students with Documented Disabilities:** If you are a student with a disability or believe you might have a disability that requires accommodations, requests for accommodations must be made in a timely fashion to Disability & Access Services, 25 Buick St, Suite 300, Boston, MA 02215; 617-353-3658 (Voice/TTY). Students seeking academic accommodations must submit appropriate medical documentation and comply with the established policies and procedures http://www.bu.edu/disability/accommodations/