MEC 541 – Elasticity

The State University of New York, Korea

Fall 2020

Instructor: Prof. Y. Eugene Pak, Academic Building B623, (032) 626-1815

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Lectures: Tue./Thur. 3:30-4:50 PM (odd weeks in person)

- First class will be in person (Aug. 25)
- Zoom will be used for online instructions
- Students should have webcam video on at all class times

Office Hours: Mon./Wed. 3:30-5:00 PM (or by appointment)

Reference Books:

- Timoshenko, S. P., "Theory of Elasticity," McGraw-Hill, 1970.
- M. H. Sadd, "Elasticity: Theory, Applications, and Numerics," 3rd ed., Academic Press, 2014 (ISBN: 978-0124081369, 3rd ed.)
- J. R. Barber, "Elasticity (Solid Mechanics and Its Applications)," 3rd ed., Springer, 2010 (ISBN: 978-9048138081)
- R. J. Asaro & V. A. Lubarda, "Mechanics of Solids and Materials," Cambridge, 2006 (ISBN: 978-0-521-16611-9)

Prerequisites :

- MEC 363: Mechanics of Solids; MEC 455/530: Applied Stress Analysis; MEC 536 Mechanics of Solids; or equivalent

Grading:

- Homework	30%	
- 2 Midterm exams @ 20% each	40%	
- Final exam	30%	

Exams: 2 Midterms (in class or take home)

1 Final TBA (9:00~11:30 AM, Monday, December 15)

No makeup exam unless arranged prior to the exam and for extenuating circumstances.

Homework: Late homework will receive half credit before the solutions are posted and will not be accepted after that.

Course Objective:

The course will provide a basic treatment of the formulation of linear elasticity theory and its application to problems of stress and displacement analysis. The objective is to provide students the ability to solve linear elasticity problems. The fundamental field equations will be developed including the strain energy concepts. Applications will involve the solution to problems of engineering interest including two-dimensional problems of plane strain and plane stress, defect and fracture mechanics, torsion, and three-dimensional problems. The course also prepares students to become professional engineers through effective communications in formulating and solving engineering problems.

Course outline

I.   Review of Linear Constitutive Relations
 1.   Generalized Hooke's law
 2.   Strain energy concepts
 3.   Stress-strain relations for linear isotropic material

II.   Formulations for Linear Elasticity
 1.   Clapeyron's theorem
 2.   Uniqueness of solution
 3.   Well-posedness of boundary value problems
 4.   Principle of superposition

III.   Saint-Venant Theory of Bending and Torsion

IV.   2-Dimensional Elasticity Problems
 1.   Plane stress and plane strain problems
 2.   Anti-plane problems

IV.   3-Dimnsional Elasticity Problems
 1.   Full space and half space fundamental problems
 2.   Spherical cavity

V.   Mechanics of Defects in Solid
 1.   Defects (dislocations and inhomogeneities)
 2.   Basic concepts of fracture mechanics
 3.   Stress analysis of cracks
 4.   Configurational forces on material defects

ABET Student Outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. An ability to communicate effectively with a range of audiences.

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Disability Support Services (DSS):

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact One-Stop Service Center, Academic Building A201, (82) 32-626-1117. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Policies:

- Students are required to use Blackboard, where important announcements, slides, homework, assignments, and supplementary materials of the course are posted. The Blackboard can be accessed at https://blackboard.stonybrook.edu/.
- The time and details about exams will be announced in the class (and also posted on the Blackboard).
- It is the responsibility of students to make sure that they can access the Blackboard and they have a working email registered with it. The Blackboard should be checked frequently for new materials.
- Exams will be closed book and note. Each person should have a calculator for the required computations.

Academic Integrity Statement:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website:

Critical Incident Management Statement:

The State University of New York, Korea expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

Attendance Policy of SUNY Korea:

1. All students of SUNY Korea are required to attend every class.
2. Unexcused absences will affect seriously the student's final grade in the course.
3. If a student has over 20% unexcused absence, the student's final course grade will be an 'F'.
4. Students should report the reason of absence to the instructor in advance, or immediately after the absence.
5. When a student excuses his/her absence, the student must provide documentation of the reason for the absence to the instructor.
6. The instructor of the course reserves the right to excuse absences.
7. The course instructor may excuse the absence if the submitted documentation fulfills the conditions below.
   - Extreme emergencies (e.g. death in the family)
   - Severe medical reasons with doctor's note (Not a slight illness)
   - Very important events (e.g. national conference, official school event)
8. At the end of semester, the course instructor should submit a copy of the attendance sheet to the Academic Affairs Office.