

# MEC 455/530 - APPLIED STRESS ANALYSIS

## Spring Semester 2017

**Credit:** 3 credits

**Prerequisite:** MEC 363 or equivalent course

**Lectures:** Mon/Wed 4:00 – 5:20PM at Physics P113

**Instructor:** Toshio Nakamura, ([toshio.nakamura@stonybrook.edu](mailto:toshio.nakamura@stonybrook.edu))  
*Include MEC455 or 530 in the subject line when emails are sent*

**Office Hour:** Mon, Thu 1:30 – 3:00PM at Light Engineering 137

**TA:** Naibin Wang ([naibin.wang@stonybrook.edu](mailto:naibin.wang@stonybrook.edu)), LE B006, TBD.

### Text/Primary Reference Book:

- *Applied Mechanics of Solids*, Alan F. Bower, CRC Press (2009).

### Other Related Books:

- *A First Course in Finite Elements*, J. Fish & T. Belytschko, Wiley (2007) This book contains student version of ABAQUS
- *Advanced Strength and Applied Stress Analysis*, R. G. Budynas, McGraw-Hill (1998).
- *Deformable Bodies and Their Material Behavior*, H. W. Haslach, R. W. Armstrong, Wiley (2004).
- *Advanced Mechanics of Materials*, R. Solecki and R. J. Conant, Oxford (2003).
- *Elasticity in Engineering Mechanics* 2<sup>nd</sup> ed. A. P. Boresi and K. P. Chong, Wiley (2000).
- *Advanced Mechanics of Materials*, R. D. Cook and W. C. Young, Prentice Hall (1998).
- *Continuum Mechanics*, G. E. Mase, *Schaum's Outline Series*, McGraw-Hill (1969)
- Textbook for MEC363 (textbook for MEC410 is also useful).
- *Finite Elements in Solids and Structures*, R. J. Astley, Chapman & Hall (2001).
- *Introduction to Finite Elements in Engineering*, T. Chandrupatla & A. Belegundu, Prentice (2002).
- *Finite Element Analysis*, G. R. Buchanan, *Schaum's Outline Series*, McGraw-Hill (1994)

**Homework:** Homework and/or computer assignments are given about every week.

**Exams:** Two mid-term tests will be given (in March & April/May). No final exam.

**Project:** Final computer project using FEM and written report will be required (due 5/9/2017)

**Grading:**

Homework (including computer assignments)	30%
Two Mid-Term Tests	45%
Finite Element Course Project	25%

### Course Learning Objectives:

The course is designed to learn the fundamentals and various solution procedures for structural problems including *analytical methods* and *finite element method*. Through understanding tensor algebra, solution formulations and various materials behaviors, students will be effectively utilized these solution techniques to determine stress and deformation fields of engineering structures and components. The course also prepares students to become professional engineers through writing detailed analysis/project reports.

### Finite Element Program:

The course will use ABAQUS finite element software. A student edition of the program can be downloaded. First create “DS Passport” by accessing to <http://academy.3ds.com/software/simulia/abaqus-student-edition/> and follow the necessary procedure. **Do this immediately to download the software.**

Manuals for some homework assignments can be downloaded from Blackboard.

A student may also use another Finite Element software for the assignments (e.g., NX I-DEAS in CADLAB?) but no assistances will be given on how to use the software.

## Topics:

- Review of Stresses and Strains, Vectors and Tensors with Indicical Notation (chap 2, appendix C).
- Energy Formulation** – fundamentals of FEM, minimum potential energy (chap 7).
- Finite Element Formulations** – interpolation functions (chap 8).
- Stress, Deformation and Strain – equilibrium and compatibility (chap 2).
- Material Behavior – constitutive equations, strain energy (chap 3).
- Simple Elastic Problems – axial loading, thin-walled cylinder (chap 4).
- 2-D Elasticity – plane stress and plane strain, Airy stress function (chap 5).
- FE Modeling and Mesh Design** – symmetry, discretization, B.C.s. (chap 7, 8).
- Strength and Failure – fracture and plasticity (chap 6, 9).

## DISABILITY SUPPORT SERVICES (DSS) STATEMENT

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

## 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 are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at <http://www.stonybrook.edu/uaa/academicjudiciary/>

## CRITICAL INCIDENT MANAGEMENT

Stony Brook University 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. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.

## CALCULATOR POLICY

Only the following calculators will be permitted to be used on all midterm and final exams in the Department of Mechanical Engineering. There will be no exceptions! This list of calculators is identical to that allowed for the National Council for Examiners for Engineering and Surveying (NCEES) Fundamentals of Engineering (FE) exam that many of you will take in your senior year, as well as Professional Engineering (PE exam) that you may take.

- Casio: All fx-115 models. Any Casio calculator must contain fx-115 in its model name.
- Hewlett Packard: The HP 33s and HP 35s models, but no others.
- Texas Instruments: All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

For detail information, follow <https://ncees.org/exams/calculator-policy/>