MEC 539 Introduction to Finite Element Method

Fall 2020

Instructor: **Prof. Lifeng Wang**
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Lecture: Thur 1:15PM - 4:05PM Online
Office Hours: Wed/Thur 10:00AM - 11:30AM Online

Remote Instruction:

- Regular in class lectures will be replaced by live and synchronous zoom sessions (to be held during class times, sessions are accessible through blackboard). These sessions will be recorded and will be available to view afterwards as well.
- I will upload all the PowerPoint slides for all chapters on Blackboard.
- I will be available during regular office hours, via live *Zoom sessions*. During these sessions we will be able to share our screens and have audio as well. I will send you hyperlinks to join these sessions.
- Outside class times and office hours - I will be available over email too and if situation warrants a short video call over Zoom or Google hangouts can be arranged by appointment.
- All exams will be held online with the aid of the Respondus LockDown browser. The exam will be deployed on Blackboard and you can appear for the exam remotely. Your activity during the exam will be recorded. A trial test will be deployed in order for you to test your setup and get used to the process.

Course Learning Objectives: This course will introduce the mathematical and physical formulation of finite element methods (FEM). An introduction to the theory of finite element methods and their application to structural analysis problems. Matrix operations, force and displacement methods. Derivation of matrices for bars, beams, shear panels, membranes, plates, and solids. Use of these elements to model actual structural problems. Weighted residual techniques and extension of the finite element method into other areas such as heat flow and fluid flow. A computer project consisting of the solution and evaluation of a structural problem is required. Physical problems will be taken from a variety of fields.

Pre-requisite knowledge:
Mechanics of Materials, Materials Science and Engineering, Strength of Materials.

Textbook: A first course in finite element method (6th Edition). Daryl L. Logan. ISBN 978-1305635111.

Suggested References:
- The finite element methods: Linear static and dynamic finite element analysis. T.J.R. Hughes. Dover Publications, 1987.
- Finite element procedures. K.J. Bathe. Prentice Hall, 1996.
- An Introduction to the Finite Element Method, J. N. Reddy, McGraw-Hill, 2005.
- A first course in finite elements, Jacob Fish and Ted Belytschko, Wiley, 2007.

Technologies and Tools:

1. **Computer and Internet Connection**: You will need to have access to computer and internet to use Blackboard.

2. **Blackboard**: The Stony Brook University uses Blackboard (Bb) course management system for all course-related management. The Bb site for this class will be the central online location for posting all class-related materials, announcements, calendar, etc.

3. **Calculators**: Only an approved NCEES allowed calculator will be permissible to use during quizzes and exams. Please see the *Calculator Policy* section below on details.

4. **Respondus LockDown Browser:** You will need to use this browser to take exams online; please download it from this link: http://www.respondus.com/lockdown/download.php?id=772113517

5. **Microphone and Webcam**: needed for participating in the discussions and commenting; also needed for on-line exam proctoring.

6. **Scanner or camera app**: A scanner to scan HW, or Exams, as necessary or you can use a smartphone or tablet camera with an app for creating high quality, cropped pdf documents, such as free version of CamScanner (search for it in Google PlayStore or Apple iTunes store). It is your responsibility to ensure that your scans will be legible without being too large in size.

Grading:

Your grade in this course will be assessed by homework, class participation, in-class-exercises, and exams.

Homework: 20%

In-class Exercises: 15%

Exam 1: 25%

Exam 2: 25%

Project reports: 15%

Homework (Online):

1. Homework will be assigned weekly and collected every Thursday Online.

2. Late homework will not be accepted.

3. All homework assignments are individual, unless otherwise specified.

4. Homework problems should be neat, professional and well organized.

Tentative Course Outline:

Week	Content	Reading
1	Introduction, Review of mathematics.	Lecture notes,
2	Introduction to the Stiffness (Displacement) Method, Energy Method	Lecture notes, Ch. 2
3	Development of Truss Equations	Lecture notes, Ch. 3
4	Development of Truss Equations	Lecture notes, Ch. 3
5	Development of Beam Equations	Lecture notes, Ch. 4
6	Development of Beam Equations	Lecture notes, Ch. 4
7	Development of Frame and Grid Equations	Lecture notes, Ch. 5
8	Exam 1 (Online)	
9	Development of the Plane Stress and Plane Strain Stiffness Equations	Lecture notes, Ch. 6, 8
10	Isoparametric Formulation	Lecture notes, Ch. 10
11	Numerical Quadrature, Three-Dimensional Stress Analysis	Lecture notes, Ch. 10, 11
12	Exam 2 (Online)	
13	Matlab Coding	Lecture notes, Handouts
14	No lecture, Thanksgiving	
15	Matlab Coding	Lecture notes, Handouts
16	Project report	

Exams (Online):

The exams are open books. If you miss an exam due to unforeseen events, you will have to contact Office of Dean of Students to send me an official notification before I will give you a makeup exam. There will be no make-up exams for reasons that are within your control. Thus, this rules out reasons such as pre-arranged vacation, travel, conflict with other exams, or other engagements.
Make-up exam policy is consistent with university policy on:
1. Student Participation in University Sponsored Events
http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/partic ipation_univsponsered_activities.php
2. University policy on Final Exams:
http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/records_registration/final_e xaminations.php
3. New York State Education Law regarding Equivalent Opportunity and Religious Absences
http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/equiv opportunity_religiousabsences.php

Academic Policies:

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. 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.
University Student Conduct Code can be found at (check for most current version)
 http://studentaffairs.stonybrook.edu/ucs/docs/universitystudentconductcode.pdf

Student Accessibility Support Center Statement: If you have a physical, psychological, medical or learning disability that may impact your course work, please contact the Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631)632-6748.

They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

https://www.stonybrook.edu/commcms/studentaffairs/sasc/facstaff/syllabus.php

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Student Accessibility Support Center. For procedures and information go to the following website: https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-people-physical-disabilities

- To access mental health services, call Counseling and Psychological Services at 631-632-6720; Counselors are available to speak with 24/7.
- For updated information on the Academic Success and Tutoring Center please check www.stonybrook.edu/tutoring for the most up-to-date information.
- For IT Support: Students can visit the Keep Learning website at https://sites.google.com/stonybrook.edu/keeplearning for information on the tools you need for alternative and online learning. Need help? Report technical issues at https://it.stonybrook.edu/services/itsm or call 631-632-2358.
- For information on Library services and resources please visit the Continuity of Library Operations guide.

Course Materials and Copyright Statement: Course material accessed from Bb, SB Connect, SB Capture or a Stony Brook Course website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor and/or the copyright holder. Duplication of materials protected by copyright, without permission of the copyright holder is a violation of the Federal copyright law, as well as a violation of Stony Brook's Academic Integrity and Student Conduct Codes.

Getting Technical Help:

Getting Help with Bb Learning Management System (LMS)
Students that need help with Bb can contact the TLT Student Help Desk by calling (631) 632-9602, emailing helpme@stonybrook.edu; more information is available via Stony Brook IT: http://it.stonybrook.edu/services/blackboard#section-6706
Frequently ask questions about the Bb LMS along with tutorials are available here:
http://it.stonybrook.edu/services/blackboard/navigate-manage

Subject to Change Notice:

All material, assignments, and deadlines are subject to change with prior notice. It is your responsibility to stay in touch with your instructor, review the course site regularly, or communicate with other students, to adjust as needed if assignments or due dates change.

Syllabus Disclaimer:

The instructor views the course syllabus as an educational understanding between the instructor and students. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. The instructor reserves the right to make changes to the syllabus as deemed necessary. Students will be notified in a timely manner of any syllabus changes via email or in the course site Announcements. Please remember to check your SBU email and the course site Announcements often.