Lecture 01: Introduction

12 January 2012
General information

Instructor: Cosme Furlong
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Course description

ES-2502
STRESS ANALYSIS
http://users.wpi.edu/~cfurlong/es2502.html

Category I

Term C’2012

LECTURES: M, Tu, Th, and F at 9:00 AM
AK–116

CONFERENCES: W at 9:00 AM
AK–116

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COURSE DESCRIPTION

The first course in engineering mechanics that addresses stress analysis of mechanical and structural elements.

Topics covered include: stresses, strains, deformations in bars, beams and torsional elements; principal stresses, transverse shear stresses, and buckling.

Recommended background: ES 2501 Introduction to Static Systems, Ordinary Differential Equations, and elementary Vector Algebra.
General information: setting of office & help session hours (attendance will be recorded)

**Office hours:** please complete survey (web)

**Help session hours:** please complete survey (web)

http://www.surveymonkey.com/s/L3BMZYF

**Office Hours:**

**Instructor:** Cosme Furlong

M, Tu, Th, and F from 10:00 to 11:00 AM or by appointment

To be rescheduled after reviewing your completed info.

**Teaching Assistants:** Morteza Khaleghi / Tatiana Popova

To be scheduled after reviewing your completed info.
PLACE ALL OF THE ASSIGNED PROBLEMS INTO A THREE-RING NOTEBOOK. Instructor will ask you to submit several of those problems (randomly chosen) for grading.

Assigned problems will be posted on our webpage soon after most lectures, normally by no later than early afternoon. Theory developed and example problems done in lectures should normally provide guidance to complete assigned homework.

Occasionally, the assignments will cover materials that we have not yet covered in lecture.
Homework

Homework will be collected twice during the week. The schedule of when homework is due and when it will be returned is as follows:

<table>
<thead>
<tr>
<th>Everything assigned before, including</th>
<th>Day due</th>
<th>Day returned &amp; solutions posted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>Wednesday</td>
<td>Friday</td>
</tr>
<tr>
<td>Tuesday/Wednesday</td>
<td>Friday</td>
<td>Monday</td>
</tr>
</tbody>
</table>
Homework

Good faith collaboration on the homework assignments is encouraged.

In good faith collaboration, students should first make serious attempts to solve the problems on their own, and only then discuss the problems with one another to clarify difficulties they may have had. If the collaboration is done properly then, even though students have worked together, the details of their solutions should still be quite different.
Exams

THERE WILL BE SEVEN (7) EXAMS. Exams will be given on Wednesdays during conference times except during last week of the term when exam will be given on Friday. Each exam will include all of the material covered until Monday (inclusive) except during last week of the term when exam will include of the material covered until Wednesday (inclusive).

Notes:

1) Please bring your textbook to the exams
2) Exams may include homework problems
3) To ensure fairness in your evaluation, the lowest exam score will be dropped.
THE GRADE FOR THE COURSE WILL BE BASED 50% ON THE EXAMS and 50% ON THE HOMEWORK.

Participation in course discussions, demonstrated engagement in the course material, demonstrated effort, and other positive contributions made to the course will strongly be taken into consideration for possible grade enhancement.
Topics covered in this course

Review outline: consult handout on course webpage
Important notes

In all of your work,

• State explicitly every assumption and/or approximation made

• Explain every procedure and justify their use

• Dimensional analyses are absolutely necessary, and therefore, all results must be expressed in appropriate units

• Your work MUST be neat, easy to follow, and professional in appearance for full credit

• PLEASE, ALWAYS SHOW ALL WORK, while writing your results on one side of a sheet of paper; start each problem on a new sheet

• PLEASE consult handout of homework, exams, and project (HER) requirements
Stress analysis in the field: examples

Bridges: calculated (estimated) stresses

Equivalent stresses

Bridges: calculated (estimated) strains

Equivalent strains

(color not shown)
Stress analysis in the field: examples

Turbine engine

Calculated (estimated) thermo-mechanical induced stresses on a blade

Model of a rotor

Stress concentration
Stress analysis in the field: examples

Tires testing

Displacement measurements: large strains induced, dynamic loads

Testing machine
Stress analysis in the field: examples
Impact stresses/strains
Stress analysis in the field (analyses): example

• Turbine blade: Vestas’ 850 kW at Holy Name high school, Worcester MA

  Analyzed as a cantilever beam

  Composite material

  Fixed to rotor

  Wind load

  Computed equivalent stresses
Deformation measurements (experiments): example

- Turbine blade: Vestas’ 850 kW at Holy Name high school, Worcester MA
Reading assignment

• Chapter 1 of textbook
• Review notes and text: ES2001, ES2501
Homework assignment

• As indicated on webpage of our course