

**Structures/Motion Lab (2003-2004, Fall Quarter)**  
**20-263-571, Sections 001, 002, 003**

**Lecture Room: 749 Baldwin**

**Laboratory Room: 584A Rhodes Hall**

**Instructor:**

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**Teaching Assistants:**

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**Required Supplies:**

**All tests will be worked in large size (8.5 in. x 11 in.) blue books. Be sure to bring two (2) to each test.**

**Each student will be required to keep a Lab Notebook, in the form of a bound, quad-ruled or lined composition book (10 in. x 8 in.). This Lab Notebook will be required for entry into the first lab experiment.**

**Each student will need a ZIP (100 Mb) disc to store data from the lab experiments.**

**Grading:**

|                      |     |
|----------------------|-----|
| Group Lab Reports(8) | 65% |
| Test Number 1        | 15% |
| Test Number 2        | 15% |
| Lab Notebook         | 5%  |

**Lab Reports:**

- *Lab Report 1 - Calibration of Sensors (Week 2-3)*
- *Lab Report 2 - Tensile/Failure Testing (Week 3-4)*
- *Lab Report 3 - Moment of Inertia Test (Week 4-5)*
- *Lab Report 4 - Beam Vibration Test (Week 5-6)*
- *Lab Report 5 - Balancing of a Rotating System (Week 6-7)*
- *Lab Report 6 - Pneumatic/Hydraulic System Comparison (Week 7-8)*
- *Lab Report 7 - Dynamics of an Electromechanical System (Weeks 9-11)*

**Text:**

- *No New Text Required*
- *Lab Handouts*
- *Measurement/Instrumentation Review Notes*  
(<http://www.sdrl.uc.edu/ucme571/ucme571.html>)

**Reference Texts: (Equivalent texts may be substituted)**

- [1] **MATLAB Primer**, Kermit Sigmon, Office of College Computing, UC-COE.
- [2] **Marks' Mechanical Engineering Handbook**, McGraw Hill, Baumeister.
- [3] **Introduction to Mechanics of Solids**, Prentice Hall, Popov.
- [4] **Mechanical Engineering Design**, McGraw Hill, Shigley.
- [5] **Design of Machinery**, McGraw Hill, Norton.
- [6] **Elementary Differential Equations and Boundary Value Problems**, John Wiley & Sons, Boyce & DiPrima.
- [7] **Theory of Vibrations**, Prentice Hall, Thomson.

## **Structures/Motion Lab - General Procedure**

- *Experiments*
  - *Experiments will be performed by groups.*
  - *Groups will consist of three members, where possible. The makeup of each group is up to the instructor. The instructor may need to assign members to a group in order to have no more than four groups in each Section.*
  - *One member of the group will be Group Leader for each lab experiment.*
- *Group Leader Responsibility*
  - *Group Leader must thoroughly understand the procedure for that week's lab experiment.*
  - *Group Leader must have data sheet prepared and/or know what data are to be recorded.*
  - *Group Leader must explain to the other group members how all calculations are performed and how results are obtained.*
  - *Group Leader must delegate responsibility to other lab group members for writing a portion of the lab report and indicate each member's contribution.*
- *Lab Reports*
  - *Lab reports are required for all experiments.*
  - *Lab reports are due, in general, ONE WEEK after the experiment is performed.*
  - *Lab reports will be graded on overall appearance, organization, neatness, etc. as well as technical content.*

**Professional Attitude:**

*Students, teaching assistants and faculty are expected to conduct themselves in a professional manner. Students and faculty are expected to arrive on-time for class/lab, to participate in discussions during class/lab, to complete assignments (lab preparation, lab reports, grading) on time, to maintain respect for fellow students and faculty and to cooperate with the goals of the class/lab. Students unable to attend class/lab should report this to the instructor via e-mail or telephone, prior to the class. Attendance at each test is mandatory; an absence must be reported prior to class with a valid excuse (illness, travel, etc.). Students should come to class/lab with the materials required for that class/lab session (book, notes, paper, pencil, calculator, blue book, etc.)*

**Communication Skills:**

*Since every class/lab period, lab report, and test is an opportunity to communicate with each other as engineers, a student's grade will depend upon their communication skills. Particularly, with respect to written work, points will be removed from the grading of a problem if the problem is not completed in an systematic and organized manner.*

**Lab Notebook:**

*Each student must maintain a Lab Notebook using a bound, quad-ruled or lined composition book. All notes in class or lab need to be taken in this Lab Notebook. All entries should be dated. Review of material presented in past classes will often be necessary prior to or during a lab exercise. Any notes taken from this review should be taken in the Lab Notebook. The Lab Notebook will be turned in with the Test Number Two and will be graded, primarily for completeness, organization, neatness, etc.*

**Tests:**

*Two tests will be given during the quarter. The dates for the tests are given in the following schedule of pertinent dates. Each test will take the full time period. Partial credit is given for organized work that is incomplete. Unless otherwise noted, all tests and the final exam will be closed book, closed notes with the exception of your Lab Notebook.*

## **Course Goals:**

*The material (lab exercises) to be covered have been selected to reinforce the student's learning in other structures/motion lecture classes. Prior knowledge of the MATLAB program is assumed and a minimal level of experience in computer programming is desirable. Some of the topics to be covered are:*

- *Introduction (Review of Past Classes)*
- *Signal Processing, Instrumentation, Measurements*
- *Tensile Testing*
- *Stress Concentration and Failure Theory*
- *Moments and Products of Inertia*
- *Sensor Calibration*
- *Analog and Digital Data Acquisition*
- *Structural Vibration Testing*
- *Response Characteristics - Hydraulic Systems*
- *Response Characteristics - Pneumatic Systems*
- *Balancing of Rotating Systems*
- *Dynamics of Electromechanical Systems*

## **Pertinent Course Dates:**

|                |                                 |   |
|----------------|---------------------------------|---|
| <i>Week 1</i>  | <i>September 24-26</i>          |   |
| <i>Week 2</i>  | <i>September 29 - October 3</i> |   |
| <i>Week 3</i>  | <i>October 6-10</i>             |   |
| <i>Week 4</i>  | <i>October 13-17</i>            |   |
| <i>Week 5</i>  | <i>October 20-24</i>            |   |
| <i>Week 6</i>  | <i>October 27 - 31</i>          | <i>(Test Number 1: October 29)</i>            |
| <i>Week 7</i>  | <i>November 3-7</i>             |   |
| <i>Week 8</i>  | <i>November 10-14</i>           | <i>(Veteran's Day Holiday: November 11)</i>   |
| <i>Week 9</i>  | <i>November 17-21</i>           |   |
| <i>Week 10</i> | <i>November 24-26</i>           | <i>(Thanksgiving Holiday: November 27-28)</i> |
| <i>Week 11</i> | <i>December 1-5</i>             | <i>(Test Number 2: December 3)</i>            |
| <i>Week 12</i> | <i>December 8-12</i>            | <i>(Exam Week)</i>                            |

**Lecture Schedule:**

| <b>Structures/Motion Lab - Lecture Schedule</b> |                             |   |
|---|-----------------------------|---|
| <b>Week</b>                                     | <b>Date</b>                 | <b>Topic</b>  |
| <i>Week 1</i>                                   | <i>Wednesday</i>            | <i>Introduction, Schedule<br/>Lab Procedure, Lab Reports</i>      |
| <i>Week 2</i>                                   | <i>Monday<br/>Wednesday</i> | <i>Sensor Calibration<br/>Measurement Review</i>                  |
| <i>Week 3</i>                                   | <i>Monday<br/>Wednesday</i> | <i>Tensile/Failure Testing<br/>Measurement Review</i>             |
| <i>Week 4</i>                                   | <i>Monday<br/>Wednesday</i> | <i>Moments/Products of Inertia Testing<br/>Measurement Review</i> |
| <i>Week 5</i>                                   | <i>Monday<br/>Wednesday</i> | <i>Structural Beam Test<br/>Measurement Review</i>                |
| <i>Week 6</i>                                   | <i>Monday<br/>Wednesday</i> | <i>Balancing of Rotating Systems<br/>Test Number 1</i>            |
| <i>Week 7</i>                                   | <i>Monday<br/>Wednesday</i> | <i>Hydraulic/Pneumatic Performance<br/>Measurement Review</i>     |
| <i>Week 8</i>                                   | <i>Monday<br/>Wednesday</i> | <i>Electromechanical Systems<br/>Measurement Review</i>           |
| <i>Week 9</i>                                   | <i>Monday<br/>Wednesday</i> | <i>Electromechanical Systems<br/>OPEN</i>                         |
| <i>Week 10</i>                                  | <i>Monday</i>               | <i>Electromechanical Systems<br/>Holiday</i>                      |
| <i>Week 11</i>                                  | <i>Monday<br/>Wednesday</i> | <i>OPEN<br/>Test Number Two</i>                                   |
| <i>Week 12</i>                                  | <i>Exam Week</i>            | <i>No Final Exam</i>  |

**Laboratory Schedule:**

| <b>Structures/Motion Lab - Laboratory Schedule</b> |   |
|--|---|
| <b>Week</b>  | <b>Topic</b>  |
| <i>Week 1</i>                                      | <i>No Lab Meetings</i>  |
| <i>Week 2-3</i>                                    | <i>Calibration of Sensors<br/>(Starts with Wednesday Lab Section)</i> |
| <i>Week 3-4</i>                                    | <i>Tensile/Failure Testing (Standard Speciman and Flat Bars)</i>      |
| <i>Week 4-5</i>                                    | <i>Moments/Products of Inertia</i>                                    |
| <i>Week 5-6</i>                                    | <i>Beam Vibration Test</i>  |
| <i>Week 6-7</i>                                    | <i>Balancing of Rotating System Comparison</i>                        |
| <i>Week 7-8</i>                                    | <i>Hydraulic/Pneumatic System</i>                                     |
| <i>Week 9-10</i>                                   | <i>Dynamics of Electromechanical Systems</i>                          |
| <i>Week 10-11</i>                                  | <i>Dynamics of an Electromechanical System</i>                        |
| <i>Week 11</i>                                     | <i>Dynamics of an Electromechanical System<br/>Open Lab Meetings</i>  |