ME 426: MECHANICAL SYSTEMS ANALYSIS LAB

CATALOG DATA:
ME 426: Mechanical Systems Analysis Lab (0-1) 1 credit
Prerequisite: ME 423 (concurrent). Use of experimental methods and modern instrumentation techniques to understand the free and forced oscillations of machines and machine components, as well as the control of these vibrations. Laboratory exercises are designed to reinforce material learned in the companion lecture class ME 423, extend knowledge into new areas, and help to make the connection between theory and practice.

TEXTBOOK:
No textbook is required.

INSTRUCTOR:
Dr. U.A. Korde, CM 130, 355-3731, Fax: 394-2405, Umesh.Korde@sdsmt.edu
Office Hours: MWF 10 AM-11 PM, T 10-11 AM, T 3-4 PM; and by prior arrangement.

CLASS SCHEDULE:
TH 9 AM-12 PM, TH 1-4 PM; see also course schedule below; CM 203.

ADA INFORMATION
Students with special needs or requiring special accommodations should contact the instructor (U.A. Korde; 355-3731; Umesh.Korde@sdsmt.edu), or the campus ADA coordinator, Jolie McCoy at 394-1924 at the earliest opportunity.

FREEDOM IN LEARNING STATEMENT:
Under Board of Regents and University policy student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Students who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should contact the dean of the college which offers the class to initiate a review of the evaluation.

ENTRANCE EXPECTATIONS:
As this is a senior-level course, students are expected to bring together foundational knowledge from other undergraduate courses, primarily those that deal with experimental measurements. Specifically, students are expected to have:
1. an ability to apply principles of measurement uncertainty,
2. written and oral communication skills,
3. basic measurement skills,
4. problem solving skills,
5. basic analysis techniques in dynamics, dynamic systems, and solid mechanics.
COURSE OBJECTIVES:
In this lab, we will use experimental methods and modern instrumentation techniques to understand the free and forced oscillations of machines and machine components, as well as the control of these vibrations. Students will work under the mentorship of a faculty member. Upon completion of the course, the student will have:
1. an ability to perform basic experimental vibration analysis,
2. an ability to carry out a formal experiment in support of developing a design concept,
3. an ability to effectively communicate the design by oral and written means,
4. team-working skills.

COURSE OUTCOMES:
Upon completion of this course, students will have demonstrated the ability to:
1. apply basic tools of experimental vibration analysis,
2. interpret experimental results in light of theoretical models,
3. make oral presentations and deliver written communications effectively,
4. work effectively in a team environment.

RELATION OF COURSE OUTCOMES TO PROGRAM OUTCOMES:
The following table indicates the relative strength of each course outcome in addressing the program outcomes (on a scale of 1 to 4, 4 indicating strong emphasis).

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<thead>
<tr>
<th>ME 426 Course Outcomes</th>
<th>Objective 1</th>
<th>Objective 2</th>
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<tr>
<td>Course Outcomes</td>
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* (Page 4 lists the objectives and outcomes for the School of Mines BSME program.)

TOPICS:
Please see the course schedule below.

COMPUTER USAGE:
Students will use data acquisition software and computer-based analysis as required by laboratory experiments.

ASSESSMENT AND EVALUATION:
Course Objectives
The course objectives will be evaluated by the following methods:
1. FE Exam
2. Exit assessment
3. Alumni survey
Course Outcomes
The course outcomes will be evaluated by the following methods:

1) LABORATORY REPORTS:
Of utmost importance in this course is the demonstrated understanding of experimental results, which goes hand-in-hand with the ability to communicate in written form. The first report will be considered a “formal” report, with the remaining ones considered “informal” (see “Guidelines for Formal Laboratory Reports” and “Guidelines for Informal Laboratory Reports”, to be provided). All lab reports will be group reports, with a self-evaluation form used to gauge individual efforts. Lab due dates are discussed below.

All engineers and engineers to be must consider themselves directly responsible for the integrity of their profession. Plagiarism damages self-confidence and reputation, and insults the hard work of other engineers. All submitted work must be your own work. Dishonesty in lab work (including plagiarism of any form) will at the very least result in a grade of zero for the entire lab exercise in question.

2) GRADING:
Final letter grades will be based on the following:
- 1 formal laboratory report: 30%
- 3 informal laboratory reports: 50%
- Laboratory participation: 20%
OBJECTIVES/OUTCOMES: BSME Program

OBJECTIVE 1: Lead and/or manage effective engineering design analyses
Outcomes:
1. Apply skills in engineering, science, and mathematics (a, e)
2. Practice effective analysis (g, k)
3. Conduct data analyses and analyses verification (b, f)

OBJECTIVE 2: Lead and/or manage effective engineering design teams
Outcomes:
4. Apply effective engineering design skills (e, f, h)
5. Demonstrate teaming proficiency (d, g, j)
6. Participate in research and professional development (f, i, j)

ABET a-k
(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
**TENTATIVE SCHEDULE FOR SPRING 2013**

<table>
<thead>
<tr>
<th>WEEK OF</th>
<th>TOPIC</th>
<th>LAB GROUPS</th>
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<tr>
<td>Jan. 7</td>
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<tr>
<td>Jan. 14</td>
<td>Lab #1: Natural frequencies of a spring-mass system</td>
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<td>3, 4</td>
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<td>5, 6</td>
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<td>Feb. 4</td>
<td>Lab #2: 2DOF vibration system</td>
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<td>Feb. 18</td>
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<td>5, 6</td>
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<td>Feb. 25</td>
<td>Lab #3: Transverse vibrations of beams</td>
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<td>Mar. 4</td>
<td>Spring Break</td>
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<td>Mar. 11</td>
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<td>Mar. 18</td>
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<td>5, 6</td>
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<td>Mar. 25</td>
<td>Lab#4: Unbalanced rotors and ring vibrations</td>
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<td>Apr. 1</td>
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<td>3, 4</td>
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<td>Apr. 8</td>
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<td>Apr. 29</td>
<td>No Final examination</td>
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**PREPARED BY:**
U.A. Korde, January 9, 2013

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1 Your lab section may be broken up into a number of lab groups, consisting of 3-4 students each. Your lab group will meet during one of the scheduled lab periods; at that time, each group member must be present and be participating in the exercise. Lab reports are due at your next designated lab group meeting or equivalent. Unexcused delays may result in that report not being accepted, or may incur a 50% loss of credit.

2 You are expected to be on time and to participate in every lab exercise. If you miss a scheduled lab with your group, you are expected to make prior arrangements to participate with another group. Such absence/rescheduling must be an exception, however, not the norm.