ME 503 - MECHANICAL ENGINEERING LABORATORY

Spring 2001

Instructor: Dr. D. N. Koert
EB 101E (978-3402)
Office hours: Generally available during laboratory periods. Available other times by appointment.

Laboratory assistants:

Harmanjit Randhawa
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Textbook: A Guide to Writing as an Engineer, by David Beer and David McMurrey, John Wiley & Sons, 1997.

Handouts and class notes will also be provided.

Reference: Current text for ME 403. Experimental Methods for Engineers, 7th edition.

Purpose: This course has several important functions. The first function is to give students additional knowledge and experience in the design and performance of experiments involving the operation of thermal and mechanical systems. The second function is to develop the student's written and oral communications skills through the use of written and oral reporting. The third function is to provide a realistic project team experience in the design and development of an experiment for instructional use in mechanical engineering.

Grading: Each of four experiments is worth a total of 100 points. These 100 points may include a quiz on the background material (handout and assigned text readings) worth a maximum of 20 points and a lab report (either written or oral) worth the remainder of the 100 points. In addition, each lab group will work on a semester long project concerned with the development of a new experiment. This project with its proposal, progress reports, final write-up, presentation and evaluation will be worth a total of 250 points or over 1/3 of the total course grade. ***EACH STUDENT WILL PROVIDE A PEER EVALUATION FOR ALL THE MEMBERS OF HIS OR HER GROUP. THE PEER EVALUATION WILL COUNT IN THE GRADING FOR UP TO 50 POINTS OF THE FINAL PROJECT SCORE.*** The final exam for the course is the presentation of the project results to the instructor and the class.

Experiments: The five experiments are (tentatively):

1 - Performance characteristics of a pump. (Written report)

2 - Diesel engine performance tests. (Oral report)

3 or 4 - Factorial Experiment. (Oral or written report)

3 or 4 - Vehicle or Heat Pump performance tests, depending on operating condition of apparatus. (Oral or written report)

5 - Group Project Lab. (Work on the project will overlap work on other experiments and include a proposal, progress report(s), a lab write-up, and observation and critique of the other groups' experiments during the semester.)

Meeting Times: Lectures about the experiments, reports, and related background material will be given in the lecture periods on Mondays and Wednesdays at 12:30 p.m. in 102 EB. We will meet every Monday and Wednesday unless otherwise specified. ***Please refer to the schedule for details.***

The laboratory sections will meet on the weeks of the experiments and for the oral presentations. Attendance and participation at the laboratory sections are mandatory. If you cannot attend one of your scheduled labs, notify the instructors as soon as possible so that arrangements may be made for you to attend another laboratory section. Unjustified absence (i.e., without written doctor's excuse or other valid reason) may result in a penalty applied to your grade for the experiment concerned. A final schedule for each experiment will be established prior to the beginning of the experiment.

Written Reports: The written reports are due by 5:00 p.m., approximately two weeks after the date your lab group performs the experiment. The tentatively scheduled dates are shown in the course schedule. Reports will be accepted up to two days after the due date, but there will be an automatic penalty of 10 points for each day the report is late. **No report will be accepted more than two days late. Any exceptions will be based on prior arrangement with the instructor for extenuating circumstances.** (For example: you were injured and could not write and have a limb in a cast or doctor's statement denoting treatment for the injury and dates of treatment.)

Written report formats will be specified by the instructor. Also, attached are other "Hints for Writing Good Reports" to be kept in mind as you create your reports.

The reports should be carefully organized and printed neatly. Word processor programs and laser printers are available in the engineering computer labs and in the ME Design Laboratory. A sloppy report will cost the grader time and you

points. ***The total length of the body of the report (less appendices and figures) should not exceed 15 printed pages.***

Oral reports: The oral reports will be presented during your laboratory section time two weeks after your lab group performs the experiment. ***Unlike the written reports which are individual efforts, the oral reports are group reports.*** The overall organization of the oral reports should be taken from the oral presentation section of the text. Each member of the group will present a different section of the report. More details about the organization and content of these reports will be provided for the experiments concerned.

Project Work: The group project work will include developing a proposal, developing an experiment, submitting progress reports, and preparing a final project report and separate student lab write-up for the experiment. A final oral presentation of the project to the class will also be required. Thus, the project grade will be based on the results of the team effort and worth a total of 250 points. ***PEER EVALUATIONS FROM ALL GROUP MEMBERS ARE REQUIRED AND WILL BE USED TO IN SCORING UP TO 50 POINTS OF THE PROJECT GRADE.*** Preliminary due dates are shown in the attached schedule.

Laboratory microcomputers and some data acquisition hardware and software are available. Use of this equipment is encouraged and may be included in the project work where appropriate.

General Comments: You should familiarize yourself with the experiment before coming to the laboratory. This will save you, your partners, and the instructor(s) time and effort. Also, your performance on the quizzes associated with the experiments will depend on this preparation. Record the data neatly in tabular form with clear column headings. Include room for written comments as the experiment progresses; do not rely on memory alone for details which may be useful in the writing of your report at a later time. Planning, neatness, and organization are essential for a successful experiment and also make subsequent report preparation much easier.

Hints for Writing Good Reports

The text by Beer and McMurrey gives a generally good discussion of what is expected in writing good engineering reports. The following is a list of hints based on difficulties encountered by students in the preparation of written reports on experiments. These items are to be kept in mind as you plan your interpretation of the experiments.

1. Do not assume your reader has complete knowledge of the experiment. Assume that your reader is interested in the experiment, but has little knowledge of what you have accomplished. Your report should be written to convey a complete picture of the experiment, from its objectives, to the methods used, to the results obtained.

2. One common problem concerns the need to provide quantitative interpretation of the results. This means a numerical description of the results, figures, etc. Most often, a reader is not as interested in the numbers you read from your instrumentation in the lab as in the significance of the results. One way to help the reader judge the significance of the results is to provide quantitative discussion of them. In order to clarify this point, consider the following typical phrases which could be used for the same figure of head vs. flow for a centrifugal pump:

   Unacceptable: For the agreement between the experimental results and the theoretical predictions, look at Figure 1.

   Poor: If you look at Figure 1, you can see that the experimental results are a little lower than the theoretical predictions at low flow rates and even lower at high flow rates.

   Good: Figure 1 shows that the experimental head values are consistently lower than the theoretical predictions; they vary continuously from 2 % lower than the theoretical values at 0 GPM (the shut off point) to 5% lower at 65 GPM.

   Note: Naturally, there is just a sentence or two of this type in the introduction and conclusions, but the results and discussion section should contain such phrases for each variable of interest.

3. It is important to write in sentences; a series of equations or tables without explanation is not sufficient!

4. All tables and figures should be referred to and discussed in the text.

5. When citing an equation, text, etc., indicate the reference. This is an excellent habit to develop. All too often an engineer is temporarily transferred to a different project for a few months or even years and afterwards finds himself or herself trying to remember the basis of work accomplished earlier on an incomplete project. Proper documentation makes this much simpler.

6. One note on style. Avoid third person references to yourself in the report (for example, "The purpose of this experiment is to teach the student . . . ") and rhetorical questions to the reader (such as, "Is it not possible that the limited accuracy of the instrumentation used caused the results to be false?"). Such phrases, while appropriate in some writing, are not appropriate in the technical reports written for this course.

7. Although different preferences for the organization of reports exist, for this course the basic organization as described in Beer and McMurrey's text is recommended. Appendices should be used when appropriate. Additional handout material on report format will be provided.

If you have any questions concerning the writing of the reports, feel free to ask.

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CLASS SCHEDULE (Preliminary)
Spring 2001

Monday/Wednesday Lectures	Monday Laboratory	Wednesday Laboratory	Thursday Laboratory
1/17 - Introduction	- -	1/17 - no meeting	1/19 - no meeting
1/22 - ***Project/Organization,*** Oral presentations, Safety 1/24 - ***Project Assignments***	1/24 - Introductory Tour ***team meeting***	1/26 -Introductory Tour ***team meeting***	1/27 - Introductory Tour ***team meeting***
1/29 - Lecture 1, Pump Experiment 1/31 - Lecture 2, Pump Experiment	1/29 - No Experiment - ***team meeting***	1/31 - No Experiment - ***team meeting***	2/1 - No Experiment - ***team meeting***
2/5 - ***Project Proposal Discussion*** 2/7 - Quiz, Pump Experiment ***2/9 - Written project statement due (5:00pm)***	2/5 - Pump Experiment - ***team meeting*** ***2/9 - Written project statement due (5:00pm)***	2/7 - Pump Experiment - ***team meeting*** ***2/9 - Written project statement due (5:00pm)***	2/8 - Pump Experiment - ***team meeting*** ***2/9 - Written project statement due (5:00pm)***
2/12 - Lecture 1, Diesel Engine 2/14 - Lecture 2, Diesel Engine ***2/14 - Project Discussion*** ***2/16 - project equipment list due (5:00pm)***	2/12 - Report Prep. - ***Project discussion and revision***	2/14 - Report Prep. - ***Project discussion and revision***	2/15 - Report Prep. - ***Project discussion and revision***
2/19 - Diesel Engine Quiz? 2/21 - No Class, Project Work	2/19 - Diesel Preview - Pump Exp. Written Report Due	2/21 - Diesel Preview - Pump Exp. Written Report Due	2/22 - Diesel Preview - Pump Exp. Written Report Due
2/26 - No Class, Project Work 2/28 - No Class, Project Work ***3/1 - Written Project Progress Report Due (5:00pm)***	2/26 - Diesel Engine Experiment	2/28 - Diesel Engine Experiment	3/1 - Diesel Engine Experiment
3/5 - Lecture 1, Experiment 3 3/7 - Lecture 2, Experiment 3	3/5 - No Experiment - ***Project Review***	3/7 - No Experiment - ***Project Review***	3/8 - No Experiment - ***Project Review***
3/12 - Quiz, Experiment 3? 3/14 - No Class, Project Work	3/12- Diesel Oral Report Due	3/14- Diesel Oral Report Due	3/15 - Diesel Oral Report Due
3/19 - Spring Recess 3/21 - Spring Recess	3/19 - Spring Recess	3/21 - Spring Recess	3/22 - Spring Recess
3/26 - Project Oral Progress & report due ***3/28 - Project Oral Progress & report due***	3/26 - Experiment 3	3/28 - Experiment 3	3/29 - Experiment 3
4/2 - Lecture 1, Experiment 4 4/4 - Lecture 2, Experiment 4	4/2 - No Experiment, Report Prep. - ***Project Review***	4/4 - No Experiment, Report Prep. - ***Project Review***	4/5 - No Experiment, Report Prep. - ***Project Review***
4/9 - Quiz Experiment 4? 4/11 - Project assistance	4/9 - Experiment 3 report	4/11 - Experiment 3 report	4/12 - Experiment 3 report

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4/16 - No Class 4/18 - No Class	4/16 - Experiment 4	4/18 - Experiment 4	4/19 - Experiment 4
4/23 - Project assistance 4/25 - Project assistance	4/23 - No Laboratory ***- team meeting***	4/25 - No Laboratory ***- team meeting***	4/26 - No Laboratory ***- team meeting***
4/30 - Project assistance 5/2 - Project assistance	***4/30 - team meeting***	***5/2 - team meeting***	***5/3 - team meeting***
5/7 - Wrap up ***5/7 - 1st draft of Semester Project report due (5:00pm)***	5/7 - No Laboratory		
5/9 - Scheduled Final Period, 10:00am to 11:50am, (Based on ~~lecture~~ meeting period) ***Oral presentations on Semester projects – Final Reports for Semester Project Due Monday, May 14, 5:00pm***