ADVANCED ENGINEERING MEASUREMENTS LABORATORY
ME 435L
Summer 2005
(50774, ME 435L-10, 4:00PM-6:50PM, Th, 17-1467)

COURSE OUTLINE: Performance of instrumentation and measurement techniques using a variety of laboratory experiences and activities. Data collection, reduction and synthesis. Design methodology of a digital data acquisition measurement system. Group collaboration and team-working skill development. Project and time management skill development.

CO-REREQUISITES: ME 435

INSTRUCTOR:
Dr. Kevin R. Anderson
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OFFICE HOURS: See web site for latest office hour postings.

REQUIRED TEXTS: **ME 435 Lab Manual** available online under ME 435L website

"LabView™ 7 Express Student Edition", Prentice Hall
ISBN 0-13-123926-0

GRADING:
Lab Reports (4 @ 20% each) = 80%
LabView Project = 20%

LABVIEW PROJECT: Goal of the project is to expose the student to the programming language Labview™. Please refer to the last page of this packet for more details.

LAB REPORTS:

- Groups collect and share ***common data***, each member of the group submits an individual write-up. Typical length of individual report is 10 ~ 15 pages including figures, tables and appendices.
- ***Four experiments*** will be performed over the duration of the 10 week quarter, by groups comprised of 2 members (in some cases no more than 3). Data is collected w/in a 3 hour lab module. Each group member submits an ***INDIVIDUAL REPORT*** .
- ***Indiviudal reports are due exactly 1 week after day of data collection***. See your instructor to examine representative hardcopy examples of *blue ribbon* reports, this will allow you to gain perspective on what is expected of you on the lab reports prior to submission for critical review.
- ***Rewrite Policy***: Any individual may resubmit a lab write-up a second time for critical evaluation after the lab has been graded and red-lined and handed back to that individual. The grade of the original submission and the rewrite will be averaged for the final write-up score, *e.g. first submission = F, rewrite = A, average overall score = C.* ***Rewrites are due 1 week after receipt of***

original red-lined individual report. BEWARE: You may receive a lower grade on a rewrite depending on whether new issues are found on the second read or not.

DRY-LABS:

In the event that lab equipment is not operating, the groups will be given a set of raw data which is representative of the lab under repair. The group members will then proceed with any appropriate data analysis/synthesis/reduction

DEADLINES:

All due dates are firm. Absolutely no extensions, no exceptions. This means you'd better start your lab reports the day that you collected the data. Be advised, putting off the write-up until the night before it is due will show through in the overall lack of quality of the finished product.

ATTENDENCE:

Mandatory in ME 435L since your teammate is counting on you. Arriving late or leaving early (before that day's module is completed) will not be tolerated. You will receive a grade of F on that day's module if any activities such as these occur.

CHEATING & PLAGIARISM:

1. Cheating is the act of behaving dishonestly for personal gain. Cheating in ME 435L will result in immediate failure of the course and the violators will be reported to the university administration.

2. Plagiarism is the act of taking the intellectual property of another and claiming it as your own.

3. Evidence of such misappropriation of other people's work is viewed as an act of plagiarism and will be dealt with accordingly.

4. ***Use of "Old Lab Reports" obtained from previous ME 435L sessions will not be tolerated.***

5. ***Use of solutions manuals is considered an act of plagiarism***.

6. Refer to pages 52-53 of the Cal Pomona 2003-2005 Catalog for further discussion of cheating and plagiarism.

7. See attached copy of ME department and College of Engineering policy on cheating and Plagiarism

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LAB ETIQUETTE:

- Students are expected to be on time for class and remain once lab has begun. Please be respectful of your colleagues and instructor. No profanity, cell phones, pagers, food or drinks allowed at any time.

- Abandoning groups (quitting, changing partners) after the 3rd week of the quarter will not be tolerated. This is a team effort, and letting down your teammate is non-professional.

ABET PROFESSIONAL COMPONENT CONTRIBUTION

Advanced Engineering Measurements ME 435/L is a course designed for senior level students to become familiar with engineering measurements and its applications. It provides a comprehensive treatment of the basic principles of measurement systems, data acquisition and analysis, experimental methods and measuring techniques in the Mechanical Engineering sector. Instructors are encouraged to incorporate practical problems in industry into lectures to help students comprehend the subject matter.

ABET INTENDED COURSE OUTCOMES FOR ME 435/L

The student is expected to become capable of:

1. Operating actual engineering instrumentation in a practical sense to support their theoretical background in engineering fundamentals
2. Executing an engineering test based on an uncertainty analysis
3. Planning the procedure of a measurement test
4. Writing a professional (industry standard) report
5. Designing a test set-up including the fundamental understanding of which sensors to use, what type of signal conditioning to employ and what type of instrumentation system is required

ABET EVALUATION OF OUTCOMES FOR ME 435L

The instructor evaluates the above outcomes using

1. Laboratory work, which is evaluated based upon
    a) The work attitude of the student in the laboratory
    b) Ability of the student to organize the experiment and delegate group work tasks
    c) Written reports of the laboratory experiment

Measurements Lab
ME 435L
Rms. 17-1467
Laboratory Rules and Etiquette

a) No food or drinks allowed in lab at any time.

b) No late arrivals will be tolerated.

c) No early departures will be tolerated.

d) Students are expected to be on time and remain for the duration of the lab session or until that day's module is complete, whichever comes first.

e) Please behave professionally.

f) No use of profanity at any time, practice to become a professional.

g) Please refrain from using cell-phones and pagers during lab time, unless it is a true emergency.

h) No horseplay

i) No uninvited guests, i.e. friends from other classes, which may act as a disturbance to that day's activities

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Memo Report Checklist

Advanced Engineering Measurements Laboratory

ME 435L

STUDENT NAME:_____

EXPERIMENT:_____

	0 = VERY POOR	1 = MARGINAL	2 = ADEQUATE	3 = VERY GOOD
ABSTRACT				
MAIN BODY				
CONCLUSIONS				
DATA ANALYSIS				
UNCERTAINTY ANALYSIS				
TABLES & GRAPHS				
REFERENCES				
FORMAT & ORGANIZATION				
NEATNESS				
GRAMMAR				
WRITING STYLE				
OVERALL UNDERSTANDING				

COMMENTS:

TOTAL=_____ /36

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ME 435 Lab Memo Report Writing Guidelines

REFER TO WEB PAGE FOR CORRECT TEMPLATE OF ME 435L REPORTS

ME 435L MEMO Report Template

""The most important technical skill a successful engineer must acquire is that of good communication. This may come in the form of verbal or written, as well as graphical. The application and mastery of these skills in presenting ideas, programs, or projects of any kind, is often the determining factor in any individual's ultimate contribution to his or her organization. Cultivation of this skill requires self-discipline in organizing thoughts prior to the communication. For similar reasons, the effective engineer organizes his or her experiments prior to initiating laboratory work."" [Ref. Dr. Winny Dong's website, Cal Poly Pomona]

""A technical or scientific report is written for one specific reason: to communicate to others exactly what has been accomplished and deduced. A supplementary benefit is that the report writer is forced to organize the information acquired and his or her convictions about it. It is important to establish that the report is an integral part of the overall technical effort and that a poor report will devalue an otherwise good piece of work. The professional report may be the primary means of convincing others of the validity of ones ideas."" [Ref. Dr. Winny Dong's website, Cal Poly Pomona]

Required Standard Memo Format for ME 435L Laboratory Reports:

It is important to state at the beginning that content is far more important than length or "appearance". In fact, a concise (8-12 pages) lab report that states the information in as few words as possible is the best. It would also be much better to invest time in improving the contents of the report as opposed to "beautifying" the graphics, etc. No one format is ideal for all types of reports. In fact the specific format will often be dictated by company or supervisor standards. A suggested outline for ME Department laboratory reports is listed below.

a) References

All references quoted in the memo heading must be cited within the body of the text. Suggested reference style is given below:

[1] Dr. Kevin R. Anderson "ME 435 Lab Manual",
www.csupomona.edu/~kranderson1/ME435L

[2] Bechwith, et. al Addison Wesley, 1995

[3] Omega Flow Rate Sensor Catalog, pgs. 102-104 www.omega.com
[4] Private communications with Dr. John Doe 2/2/03

b) Abstract/Executive Summary

3 or 4 sentences stating Who, What, When, Where and Why. The followed by most importantly), list the most pertinent finding(s) of your experiment and quantify via an uncertainty analysis. For example, the temperature was found to be $T = \overline{T} \pm u_T = 60 \pm 0.5\ ^\circ\text{C}$. Note: the abstract can be as many as two or three paragraphs long, whatever space it takes to summarize all of the results. See Dr. Anderson's office database for examples of great abstracts.

c) Background/Theory/Procedure

Tie in the theory elements from the course lecture session to the hardware you are using in your test. For example, how does an LVDT work ? Illustrate to the reader that you are acquainted with the pertinent physics of the experiment and you know of the limitations in any assumptions made in the theory. Quickly cite the procedure used by referring to the Lab Manual, e.g. the procedure listed on pages 10-12 of [1] was followed. Do not reiterate the lab manual word for word.

d) Discussion of Results

Quantify your findings by referring to the Figures and Tables which appear in the body of the text or as attachments to your report. All Figures, Tables and Appendices must be referred to within the body of the report. Don't assume the reader will find them on his/her own.

e) Summary/Conclusions/Recommendations

Your conclusion may appear three times: in the Discussion, the Summary and the Abstract. Do not repeat the wording; rephrase it. If the reader has not understood one version, another may help. Use the shortest version for the Summary

f) Figures

All figures appearing the report must be used in the discussion portion of the report. Do not simply attach a set of figures hoping that your reader will be able to interpret what facts you are trying to convey. You must walk the reader through each and every figure appearing in the report, i.e. in figure 1 a plot of temperature versus time is shown, where the y-axis shown temperature in degrees Celcius and the x-axis shows time in units of minutes. (See ME 435L archives in Dr. Anderson's office for proper protocol regarding proper preparation of Lab Report Figures).

g) Appendices

All hand-calculations, web based research for product spec sheets, raw data sheets must appear in a clearly labeled and reference Appendix, *e.g.* the raw data which was

gathered appears herein as Appendix A, or please refer to Appendix B for a listing of the manufacturer's spec sheet for the Omega DC-LVDT model #2220.

Miscellaneous Parting Thoughts and Advice

a) All pages excluding the title page must have page numbers.
b) Always spell check your report before turning it in for evaluation.
c) Do not submit a first draft as a final report. This means you'll have to get the report done well before the night before it's due.
d) Do not include attachments that you do not intend to reference in the main body of the text. The use of such "filler" material is not value-added to the overall quality of the report.
e) If you don't know how to quantify something, stop by the office hour. It is better to try and offer a plausible explanation of what may seem counterintuitive than to state simply punt, or plead the 5th. Many real world problems do not have an intuitive answer, but their behavior can be rationalized with the theory and modeling tools you have at your beckon. I am here to help, please use my consulting services.

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ME 435L Summer 2005 Weekly Lab Assignments

ME 435L	Section 10	Summer 2005
	Time 4-6:50 PM	
Meeting #	Date	Activity
1	Thursday, June 23, 2005	G1/L1 G2/L2 G3/L3 G4/L4
2	Thursday, June 30, 2005	Dr. Anderson out of town
3	Thursday, July 07, 2005	G5/L1 G6/L2 G7/L3 G8/L4
4	Thursday, July 14, 2005	G1/L2 G2/L3 G3/L4 G4/L1
5	Thursday, July 21, 2005	G5/L2 G6/L3 G7/L4 G8/L1
6	Thursday, July 28, 2005	G1/L3 G2/L4 G3/L1 G4/L2
7	Thursday, August 04, 2005	G5/L3 G6/L4 G7/L1 G8/L2
8	Thursday, August 11, 2005	G1/L4 G2/L1 G3/L2 G4/L3
9	Thursday, August 18, 2005	G5/L4 G6/L1 G7/L2 G8/L3
Lab #	Description	
1	Heat Fin	
2	Themal Conductivity	
3	Accelerometer	
4	Pressure Transient	

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ME 435L Summer 2005 Labview™ Programming Project
Assigned 6/30/05, due 8/11/05 by 5 PM in Dr. Anderson's mailbox

STUDENT NAME:_____

Write a Labview™ VI that will perform the following tasks on a generic set of data:

1. Scan for outliers using the "*3 Sigma"* rule
2. Plot a curve fit of the data via Linear Regression in the form: $y_c = a_o + a_1 x + \ldots + a_m x^m$
3. Report the R^2 value of the fit of part 2.
4. Report the mean of the data set
5. Report the standard deviation of the data set
6. Report the variance of the data set
7. Report the static sensitivity of the data set

Your Labview™ VI should include a Graphical User Interface (GUI) which allows the user to select a set of data and plot it both in raw format and with a curve fit overlaid.

Debug your Labview™ code using the following data sets:

Data Set 1: Displacement Transducer data

y (V)	2.7	3.6	4.0	4.4	5.2	9.2
x (m)	0.4	1.1	8.96	1.9	3.0	5.0

Data Set 2: Fan Performance Data

Q (m^3/sec)	2000	6000	10000	12000	14000	18000	22000
h (cm H_2O)	5.56	5.87	5.73	9.38	4.95	3.52	1.08

Data Set 3: Valve Calibration Data

y (kg/s)	0.14	2.51	8.905	15.30	39.505	63.71
x (V)	0.5	2.0	17.0	5.0	79.0	10.0

Deliverables:

Turn in this cover sheet, set of operating instructions/users manual, a hardcopy of your Labview™ code, all output and plots in a binder. Also include a CD with all Labview™ code and debugging runs on. Reminder: this project is worth 20% of your ME 435L course grade.