Last Revised: 10/16/2018

The University of Texas at San Antonio
Department of Mechanical Engineering
ME 3113 Measurements & Instrumentation
Syllabus

Part A – Course Outline

Required Course in Mechanical Engineering

Course Description:
Fundamentals of measurement systems theory and laboratory practice; descriptive statistics, probability distributions, error, uncertainty analysis, confidence intervals, hypothesis testing, correlation, linear regression, and plotting. Technical report writing and data acquisition with NI Elvis boards and Multisim, RC circuits, op-amps, filters, strain gauges, and basic embedded systems and programming.

Prerequisites:
EE 2213 - Electric Circuits and Electronics (requires a grade of C- or better)
EGR 2513 - Dynamics (requires a grade of C- or better)
PHY 1951 - Engineering Physics 1 Lab (requires a grade of C- or better)
PHY 1971 - Engineering Physics 2 Lab (requires a grade of C- or better)

Recommended textbook:
Holman, J. P., Experimental Methods for Engineers, 8th Edition, McGraw-Hill

Major prerequisites by topic:
1. Physics
2. Calculus
3. Differential Equations
4. Circuit Analysis
5. Statics

Topics covered:
1. Fundamental measurement instruments and laboratory equipment
2. Introduction to *EXCEL*, *LabVIEW*, and *MATLAB*
3. Basic statistics for measurements and instrumentation
4. Data presentation in charts and tables
5. Descriptive statistics
6. Probability applied to measurement systems
7. Probability distributions in measurements
8. Sampling and confidence intervals
9. Regression analysis
10. Uncertainty analysis
11. Introduction to DC and AC circuits
12. Filter circuits
13. Bridge circuits
14. Theory and application of strain gages
15. Application of strain gages to solve engineering problems

16. Temperature measurements
17. Temperature measurements using thermocouples
18. Temperature measurements using thermistors
19. Introduction to inductance theory
20. Application of inductance theory to design LVDTs and seismometers
21. Accelerometer theory
22. Application of accelerometers to solve engineering problems

Contribution of course to meet the professional component:
This course builds the foundation for preparing students to work professionally in the area of measurements and instrumentation.

Relationship of course to Student Outcomes:
This course primarily contributes to Mechanical Engineering program student outcomes:
(a) an ability to apply knowledge of mathematics, science, and engineering
(e) an ability to identify, formulate, and solve engineering problems
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) an ability to apply principles of engineering, basic science, and mathematics to model, analyze, design, and realize physical systems, components or processes; and prepare students to work professionally in both thermal and mechanical systems areas.

The course contributes in a secondary way to Mechanical Engineering student program outcomes:
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(i) a recognition of the need for, and an ability to engage in life-long learning

Course Objectives (contribution to Student Outcomes):
For students to demonstrate
1. Ability to apply knowledge in math, science, and engineering to solve measurement problems using statistics theory, circuit analysis, and solids. Develop the theoretical bases for strain, temperature, accelerometer, and inductance instruments (a, e, l)
2. Ability to design and conduct experiments to apply electric components, strain gages, thermistors, thermocouples, accelerometers and mechanical measuring instruments (l)
3. Ability to develop techniques and skills to use modern engineering tools by using computers to record and analyze data (l)
4. Ability to design an instrument to meet desired needs with realistic constraints (k)
5. Ability to work in multidisciplinary teams (g)
6. Ability to incorporate the ethical principles of professionalism in course activities by honest data reporting and report preparation (f)
7. Ability to strengthen written, graphical and verbal communication skills through report preparation (g)
8. Develop skills necessary to support life-long learning through researching information to respond to questions posed in lecture and laboratory classes (i)

Performance Criteria:
Student Outcomes will be evaluated through the analysis of the evaluation results of homework, quizzes, pre-labs, lab notebook, reports, presentations, attendance, and participation.

Course Coordinator: Christopher Combs

The University of Texas at San Antonio
Department of Mechanical Engineering
ME 3113 Measurements & Instrumentation
Fall 2018
Syllabus

Part B – General Information

Instructor: Christopher Combs, Ph.D.
Office: EB 3.04.26
E-mail: ccombs@utsa.edu
Office Hours: Monday & Wednesday 9-11 AM or by appointment

Time: Lecture: Monday & Wednesday 2-2:50 PM (CRN: 16921)
Labs: To be arranged

Location: Lecture: MH 2.01.12
Labs: EB 3.04.68

Teaching Assistants: Maria Aranguren, Email: maria.aranguren@utsa.edu
Ian Bashor, Email: ib17@evansville.edu
Stephanie Cottier, Email: stephcottier02@gmail.com
Andres Tapia, Email: andrestc94@hotmail.com

Grading:
The grading will be calculated as follows:

Quizzes and Surveys	5%
Statistics Assignment	2%
Excel Assignment	5%
Literature Review Assignment	3%
MATLAB Assignment	5%
Midterm Exam	15%
Final Exam	15%
Lab 1 (Due in Lab 9/12 or 9/13)	5%
Lab 2 (Due in Lab 9/24 or 9/25)	10%
Lab 3 (Due in Lab 10/10 or 10/11)	10%
Lab 4 (Due in Lab 10/24 or 10/25)	10%
Lab 5 (Due in Lab 11/14 or 11/15)	15%
Total	**100%**

A standard decade scale (A ≥ 90%, B+ = 88-89.9, B = 80-87.9%, C+ = 78-79.9%, C = 70-77.9%, D = 60-69.9%, F < 60%) will be used to assign final grades in this course.

Lab Assignments:
The lab assignments are due within 5 minutes of the start of your lab session per the dates in the grade distribution above and the schedule below, dependent on your lab session. Turning in a lab assignment late will result in an immediate 20% reduction in grade. For any lab assignment turned in late, there will be a 20% penalty for each day the assignment is late, up until all possible points have been lost after one class week. The lowest score of the first four labs will be dropped (lab 5 must be counted).

Lab Attendance:
Lab attendance is mandatory and failure to attend your scheduled lab without an official excused absence will result in a 10% reduction in the score for the associated assignment. Missed labs should be made up as soon as possible, preferably by attending a different lab session. Arriving more than 5 minutes late to a lab will constitute a missed lab.

Exam Policy:
Per the UTSA Mechanical Engineering Department's exam policy, there will be no bathroom breaks during an exam (unless a student provides a medical note). There will also be no electronic devices (phone, smart watch, camera, electronic glasses, computer, unapproved calculator, etc.) on student body (in pockets, boots, clothing, etc.) or within reach (under seat, on adjacent seat, etc.) during exams. Having an unapproved electronic device accessible during an exam will be considered cheating and handled as a case of academic dishonesty.

Approved Calculators for Exams:
The FE exam calculator policy (www.ncees.org) will be used for exams. Only the models listed below may be used during exams:

Hewlett Packard – all HP 33s and HP 35s (~$60) models
Casio - all fx-115 (~$17) and fx-991 (~$18) models
Texas Instruments - all TI-30X (~$10) and TI-36X (~$19) models

Excused Absences:
Excused absences include personal illnesses, deaths in the family, religious holidays, and UTSA sponsored activities. For illnesses, you must provide documentation (physician's statement/note, etc.) within 3 class meetings in order to be excused. Absences in observance of religious holidays are authorized only if you notify your instructor in writing (email or physical note) at least one week in advance. UTSA sponsored events require an original signed letter on UTSA letterhead from the faculty or staff sponsor.

Make-up Exams:
Make-up exams will not be allowed unless previously approved by the instructor.

Late Work:
Late work will only be accepted if a student has an excused absence on the day an assignment is due. Students missing class on the due date of an assignment owing to a planned excused absence (religious holiday or UTSA sponsored activity) should arrange with the instructor an appropriate time to submit the assignment. If an assignment is not submitted, the grade will always be a 0.

Lecture Attendance:
While attendance in the lecture portion of the class is not mandatory, the student will be responsible for learning all of the material covered in the lectures. Unannounced quizzes may be given during lecture to review previously covered material.

Extra Credit
Any potential extra credit opportunities will be offered by the instructor to the class as a whole and will never be offered exclusively to individual students hoping to improve their grade. Solicitations by students for extra credit opportunities will not be provided with a response, given that this action would violate UTSA policy by promoting differential treatment between students.

Scholastic Dishonesty:
Scholastic dishonesty is a serious offense that includes, but is not limited to, copying homework, cheating on a test, plagiarism, or collusion. The Office of Student Life (458-4720) should be contacted if a student has questions about what constitutes scholastic dishonesty/ http://utsa.edu/studentlife/conduct/scholastic_dishonesty.html

While it is acceptable to look at other students' reports for the purpose of seeing the format and style, it is a violation of University policy to plagiarize (copy) text from other students' work without proper citation. Figures must also be original.

Cases of suspected scholastic dishonesty related to exams and written reports will be prosecuted through the UTSA Office of Student Life, with the recommended penalty that the student receive an "F" grade for the class.

Blackboard:
Some of the documents you need for this course will be posted in Blackboard. It is your responsibility to check Blackboard on a regular basis throughout the semester. I may post important messages regarding assignments, schedules, and any changes to the syllabus through in Blackboard. These messages may require a response from you. Some assignments and quizzes will be posted to Blackboard as well.

To learn how to navigate Blackboard, you can view these tutorials:
https://www.youtube.com/playlist?list=PLontYaReEU1seUE3ACG3sEc3zR7Br7URU

Electronic Devices:
Laptops and/or tablets are encouraged in class. I will show you step-by-step how to complete various assignments and we will also have activities where your electronic devices will be very useful to you. (Remember, you can borrow a laptop from the library: https://lib.utsa.edu/services/technology-lending).

Phones must be on silent or vibrate during class time. If you are using your device in a way that is distracting or not related to class, you may be asked to either put away the device or to leave class. Also, please do not sit in class with headphones or earbuds in your ears. This can be distracting and is considered to be unprofessional.

Audio/Video Recording:
Feel free to record any lectures or presentations in my class for your own personal use. However, these recordings may not be duplicated, shared, or disseminated without the express written consent of the instructor.

Course Evaluation:
I use the feedback provided by my students in course evaluations to improve my teaching. Additionally, course evaluations are a strategy used by the university as one factor in evaluating an instructor's effectiveness. As a faculty member, I encourage you to complete the course evaluation during the availability period near the end of the semester so that I can make improvements for my next group of students.

University Policies:
Required university policy link: http://teaching.utsa.edu/wp-content/uploads/2018/07/Required-University-Policies.pdf

Roadrunner's Creed: https://www.utsa.edu/studentlife/creed.html

Student Support Services:
http://teaching.utsa.edu/wp-content/uploads/2018/07/UTSA-Student-Support-Services.pdf

Responsible Employee Notice:
The University has an obligation to maintain an environment free of sexual harassment and sexual violence, thus many University employees, including the instructor, have mandatory reporting and response obligations and may not be able to honor a complainant's request for confidentiality. Complainants who want to discuss a complaint in strict confidence may use the resources outlined in HOP Section IX.A.5, "Confidential Support and Resources" at the following link: http://www.utsa.edu/hop/chapter9/9-24.html

Disclaimer:
This syllabus is provided for informational purposes regarding anticipated course content and schedule of courses. It is based on the most recent information available on the date of its issuance and is as accurate and complete as possible. I reserve the right to make any changes necessary and/or appropriate and will make every effort to communicate any changes in a timely manner in class. Students are responsible for staying up to date on any changes to the syllabus that may occur during the term of this course.

Last Revised: 10/16/2018

The University of Texas at San Antonio
Department of Mechanical Engineering
ME 3113 Measurements & Instrumentation
Fall 2018 | M/W 2:00pm-2:50pm | MH 2.01.12
Course Schedule

(all dates tentative, changes will be announced in class)

Class	Date	Day	Topic	Assignments Due
1	Aug 22	W	Introduction	
2	Aug 27	M	Instrum. & Equip. Overview	Beginning of Semester Survey
3	Aug 29	W	Intro. to Data Acquisition	
	Sep 3	*M*	*Labor Day – No Class*	
4	Sep 5	W	Intro. to Data Acquisition	
5	Sep 10	M	LabVIEW	
6	Sep 12	W	Statistics and Uncertainty I	Lab 1 (Due in Lab)
7	Sep 17	M	Statistics and Uncertainty II	
8	Sep 19	W	Statistics & Uncertainty III/Excel	
9	Sep 24	M	Statistics and Uncertainty IV	Lab 2 (Due in Lab), Statistics Assignment
10	Sep 26	W	Basic DC & AC Circuits	
11	Oct 1	M	Midterm Exam Review	Excel Assignment
12	**Oct 3**	**W**	**Midterm Exam**	
13	Oct 8	M	Op-Amps and Filters I	Midterm Survey
14	Oct 10	W	Op-Amps and Filters II	Lab 3 (Due in Lab)
15	Oct 15	M	Op-Amps and Filters III	
16	Oct 17	W	Op-Amps and Filters IV	
17	Oct 22	M	Bridge Circuits	
18	Oct 24	W	Measuring Force/Stress/Strain	Lab 4 (Due in Lab)
19	Oct 29	M	Technical Writing	
20	Oct 31	W	MATLAB I	
21	Nov 5	M	MATLAB II	
22	Nov 7	W	Generating Figs. and Tables	
23	Nov 12	M	Temperature Measurements	Literature Review Assignment
24	Nov 14	W	Pressure Measurements	Lab 5 (Due in Lab)
25	Nov 19	M	Inductance theory & LVDTs	
26	Nov 21	W	Detectors and Cameras	
27	Nov 26	M	Accelerometers	MATLAB Assignment
28	Nov 28	W	Adv. Meas. Techniques	
29	Dec 3	M	Final Exam Review	End of Semester Survey
30	**Dec 5**	**W**	**Comprehensive Final Exam**	**LAST LECTURE DAY**