Course Changes

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GRADUATE STUDIES

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R. AUTENRIETH

Texas A&M University
Departmental Request for a Change in Course
Undergraduate • Graduate • Professional

• Submit original form and attachments •

Form Instructions

1. Request submitted by *(Department or Program Name)*: Civil Engineering
2. Course prefix, number and complete title of course: CVEN 626 - Roadside Safety Design

Attach a brief supporting statement for changes made to items 3a thru 3d, and 6 below.

3. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

Cross-listed courses require the signature of both department heads.

   d. Change in course title and description. Enter complete current course title and current course description in item 5; enter proposed course title and proposed course description in item 6. Complete item 7 for change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 7. **Attach a course syllabus.**
4. For informational purposes only, please indicate course number if this course will be stacked: _____
5. Complete current course title and current catalog course description: CVEN 626 - Roadside Safety Design
   Fundamental concepts of designing safety into roadways; safety improvement programs, accident data analysis, safety methodology, safety in cross section design and the design of safety devices; safety improvement programs, sideslopes and ditches, breakaway devices, crash cushions and roadside barriers.
6. Complete proposed course title and proposed catalog course description (not to exceed 50 words): CVEN 626 - Highway Safety
   Fundamental concepts for performing traffic safety analyses; crash data collection and database management; safety improvement programs; accident data analysis; development of statistical models; before-after studies; economic analyses; accident risk.
7. a. As currently in course inventory:

Prefix	Course #	Title (excluding punctuation)
CVEN	626	ROAD SAFETY DESIGN

Lect.	Lab	SCH	CIP and Fund Code	Admin. Unit	FICE Code	Level
03	00	03	14080100 0006	0630	003632	6

b. Change to:

Prefix	Course #	Title (excluding punctuation)
CVEN	626	HIGHWAY SAFETY

Lect.	Lab	SCH	CIP and Fund Code	Admin. Unit	Acad. Year	FICE Code	Level
03	00	03	14080400 0006	0630	13-14	003632	6

Approval recommended by:

Mark Burris — Department Head or Program Chair *(Type Name & Sign)* — 7/7/12 Date

Department Head or Program Chair *(Type Name & Sign)* — Date
(if cross-listed course)

Scott L. Miller — Chair, College Review Committee — 7/11/12 Date

Scott L. Miller — Dean of College — 7/11/12 Date

Mark Zoran — Chair, GC or UCC — 8-21-12 Date

Submitted to Coordinating Board by:

Associate Director, Curricular Services — Date — Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 02/11

CVEN 626 – HIGHWAY SAFETY
3 Credits
Spring 2013

Elective

Description: Fundamental concepts for performing traffic safety analyses; crash data collection and database management; safety improvement programs; accident data analysis; development of statistical models; before-after studies; economic analyses; accident risk.

Lecture: Tuesday, 2:20-5:10 pm, CVLB109 (to be confirmed)

Textbook: Road Safety Manual (2003) World Road Association. I will reserve this document at the library. Please install the CD-ROM on your computer.

Highly recommended Textbooks:

AASHTO (2010) Highway Safety Manual. American Association of State Highway and Transportation Officials. Washington, D.C.

Hauer, E. (1997) Observational Before-After Studies in Road Safety: Estimating the Effect of Highway and Traffic Engineering Measures on Road Safety. Elsevier Science Ltd, Oxford.

Hilbe, J.M. (2011) Negative Binomial Regression. Cambridge University Press, Cambridge, UK.

Additional relevant material:

WHO (2004) World Report on Road Traffic Injury Prevention. Eds. Peden et al. World Health Organization, Geneva. (http://www.who.int/violence_injury_prevention/publications/road_traffic/world_report/en/)

Ogden K. (1996) Safer Roads: A Guide to Road Safety Engineering. Ashgate Publishing, Limited, Hampshire, England.

Hilbe, J.M. (2007) Negative Binomial Regression. Cambridge University Press, UK.

Cameron, A.C., and P.K. Trivedi (1998) Regression Analysis of Count Data. Cambridge University Press, Cambridge, U.K.

Persaud, B.N. (2001) Statistical Methods in Highway Safety Analysis. NCHRP Synthesis of Highway Practice 295, TRB, Washington, D.C. (http://gulliver.trb.org/publications/nchrp/nchrp_syn_295.pdf)

Elvik, R. and T. Vaa (2004) Handbook of Traffic Safety Countermeasures. Elsevier Science. Amsterdam, The Netherlands.

ITE (1999) The Traffic Safety Toolbox: a primer on traffic safety. Institute of Transportation Engineers, Washington, D.C.

Additional reading material will be provided in class. I attached a partial list of documents relevant for this course. Additional references will be provided during class.

Prerequisites:

Recommended courses: traffic engineering (CVEN 457), geometric design (CVEN 456) and statistics (STAT 601 or STAT 211) and/or approval from the instructor.

Course Philosophy and Structure:

During each session (week) I will assign work to be done. I strongly believe that one learns more from reading and discussing with your colleagues than from listening. The work may take the form of problem sets, readings, or small projects. Class participation is essential for course. In addition, I will ask each student to prepare a term paper on a specific topic in traffic safety. The paper will deal with a specific problem statement in traffic safety. At the end of the course, each student will present the results of their research/term paper. Additional information will be provided at the beginning of the class.

Instructor:

Dr. Dominique Lord
CE/TTI Room 301
Tel. (979) 458-3949
e-mail: d-lord@tamu.edu

Course objectives:

Provide fundamental engineering bases for conducting traffic safety analyses and a critical look at the state-of-the-art methods in traffic safety.

Course Outcome:

Understand the basic concepts of highway safety and the crash process. Conduct safety-related studies: safety performance functions, before-after studies and identification of hazardous sites. Critically review the literature

Topics:

1. Introduction: What is Traffic Safety? (1 week)

Key Topics: Definition and meaning of "safety" and "motor vehicle accident." Magnitude of the problem in the U.S. and around the world.

Material: RSM: Chapter 1, Hauer: Chapter 1, WHO: Chapter 2.

- NHTSA (2009) Traffic Safety Facts 2008. US Department of Transportation, Washington, D.C.

2. Human Factors in Traffic Safety (1 week)

Key Topics: Interaction between the driver, the road and the vehicle. Human contribution in road accidents. Effects of gender and age on crash risk. Issues with perception, work load and driver expectancies.

Material: RSM: Part III – Human Factors, Evans (2004) Traffic Safety: Chapters 2 and 5.

- AAHSTO (2010) Highway Safety Manual: Chapter 2. 1st Edition. Washington, D.C.
- Dewar, R.E., and P.L. Olson. (2007) Human Factors in Traffic Safety. 2nd edition, Lawyers & Judges Publishing Company, Inc., Tucson, AZ.
- Shinar, D. (2007) Traffic Safety and Human Behavior. Elsevier Ltd, Oxford, U.K.
- Lundberga, J., C. Rollenhagenb, and E. Hollnagelc (2010) What you find is not always what you fix—How other aspects than causes of accidents decide recommendations for remedial actions. Accident Analysis & Prevention, in press (Aug. 2010).

3. Economic Costs of Crashes and Value of Life (1 week)

Key Topics: Economic costs of crashes, both societal and human related. Methods for evaluating crash costs (value of life). Relationship between crash costs and injury costs in other health areas.

Material: RSM: Chapter 1, Evans (1991): Chapter 1, WHO: Chapter 2.

- AAHSTO (2010) Highway Safety Manual: Chapter 7. 1st Edition. Washington, D.C.
- Czech, S., A.P. Shakeshaft, J.M. Byrnes, and C.M. Doran (2010) Comparing the cost of alcohol-related traffic crashes in rural and urban environments. Accident Analysis & Prevention, Vol. 42, No. 4, pp. 1195-1198.

- Svensson, M., and M.V. Johansson (2010) Willingness to pay for private and public road safety in stated preference studies: Why the difference? Accident Analysis & Prevention, Vol. 42, No. 4, pp. 1205-1212.
- Zaloshnja, E, T. Miller, E. Romano, and R. Spicer. (2004) Crash Costs by Body Part Injured, Fractured Involvement, and Threat-to-Life Severity, United States, 2000. *Accident Analysis and Prevention*, Vol. 36, No. 3, pp. 415-427.
- Blincoe, L.J., A.G. Seay, E. Zaloshnja, T.R. Miller, E.O. Romano, S. Luchter, and R.S. Spicer (2002) The Economic Impact of Motor Vehicle Crashes. NHTSA Technical Report HS-809 446, NHTSA, Washington, D.C. (http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/Communication%20&%20Consumer%20Information/Articles/Associated%20Files/EconomicImpact2000.pdf)
- Hauer, E. (1994) Can One Estimate the Value of Life or is it better to be Dead than Stuck in Traffic? *Transportation Research, Part A*, Vol. 28, No. 2, pp. 109-118.
- Lawson, J. (1988) The Cost of Road Accidents. In Proceedings of the 3rd World Congress of the International Road Safety Organisation PRI, June 10-14 1999, Montreal, Canada, pp. 34-47.

4. Crash Data Collection and Database Management (1 week)

Key Topics: Methods for collecting data. Sources of data needed for conducting safety studies. Database management. Geo-referenced database. Issues with crash data.

Material: RSM: Chapter 4, Hauer: Chapter 4.

- AAHSTO (2010) Highway Safety Manual: Chapter 3. 1st Edition. Washington, D.C.
- Elvik, R., A.B. Myson (1999) Incomplete Accident Reporting: a Meta-Analysis of Made in Thirteen Countries. *Transportation Research Record 1665*, pp. 133-140.
- Hauer, E., and A.S. Heckert (1987) Extent and Some Implications of Incomplete Accident Reporting. *Transportation Research Record 1185*, pp. 1-8.
- James, H.F. (1991) Under-Reporting of Road Traffic Accidents. *Traffic Engineering & Control*, Vol. 32, pp. 574-583.

5. Elements of Statistics and Crash Count Distributions (1 week)

Key Topics: Basic principles of crash count data. Crash process. Overdispersion in crash data. Causal-relationship models.

Material: RSM: Chapter 4, Hauer: Chapter 4, Class notes

- AAHSTO (2010) Highway Safety Manual: Chapter 3. 1st Edition. Washington, D.C.
- Lord, D., S.P. Washington, and J.N. Ivan (2005) Poisson, Poisson-gamma and Zero-Inflated Regression Models of Motor Vehicle Crashes: Balancing Statistical Fit and Theory. *Accident Analysis & Prevention*, Vol. 37, No. 1, pp. 35-46.
- Davis, G. (2004) Possible Aggregation Biases in Road Safety Research and a Mechanism Approach to Accident Modeling. *Accident Analysis & Prevention*, Vol. 36, No. 6, pp. 1119-1127.

- Elvik, R. (2003) Assessing the Validity of Road Safety Evaluation Studies by Analyzing Causal Chains. *Accident Analysis & Prevention*, Vol. 35, No. 5, pp. 741-748.

6. Exploratory Analysis of Crash Data (1 week)

Key Topics: Exploratory Data Analysis of Crash Data. Estimation of confidence intervals.

Material: RSM: Chapter 4, Tukey (1977) Exploratory Data Analysis: Chapters 1-5, Class notes.

- Washington, S.P., Karlaftis, M.G., Mannering, F.L., (2003) Statistical and Econometric Methods for Transportation Data Analysis. Chapman Hall/CRC, Boca Raton, FL.

7. Regression Analysis of Count Data and Development of Statistical Models (2 weeks)

Key Topics: Development and application of statistical predictive models in traffic safety.

Material: RSM: Chapter 5, Hauer: Chapter 12, Cameron and Trevedi: Chapter 3, Persaud: Chapter 2.

- Lord, D., and F. Mannering (2010) The Statistical Analysis of Crash-Frequency Data: A Review and Assessment of Methodological Alternatives. Transportation Research - Part A, Vol. 44, No. 5, pp. 291-305.
- Miaou, S.-P., and D. Lord (2003) Modeling Crash Traffic-Flow Relationships for Intersections: Dispersion Parameters, Functional Forms, and Bayes versus Empirical Bayes. *Transportation Research Record 1840*, pp. 31-40.
- Lord, D. (2005) Modeling Motor Vehicle Crashes using Poisson-gamma Models: Examining the Effects of Low Sample Mean Values and Small Sample Size on the Estimation of the Fixed Dispersion Parameter. Presented at the 85th Annual Meeting of the TRB.
- Maher M.J., and I. Summersgill. (1996) A Comprehensive Methodology for the Fitting Predictive Accident Models. *Accident Analysis & Prevention*, Vol. 28, No. 3, pp.281-296.
- Wood, G.R. (2002) Generalized Linear Accident Models and Goodness of Fit Testing. *Accident Analysis & Prevention*, Vol. 34, pp. 417-427.

8. Before-After Studies (2 weeks)

Key Topics: Fundamental principles for evaluating the effects of traffic safety interventions. Before-after study with and without control groups. Site selection and regression-to-the-mean biases. Empirical Bayes and full-Bayes methods.

Material: RSM: Chapter 4, Hauer: Chapters 6-12, Persaud: Chapter 2 & Appendices D & E

- Maher, M., and L. Mountain (2010) The sensitivity of estimates of regression to the mean. Accident Analysis & Prevention, in press.

- Park, E.S., Park, J., Lomax, T.J. (2010) A fully Bayesian multivariate approach to before–after safety evaluation. Accident Analysis & Prevention, Vol.42, No. 4, pp. 639 1118-1127.
- Persaud, B.N., and C. Lyon. (2007) Empirical Bayes Before-and-After Safety Studies: Lessons Learned from Two Decades of Experience. Accident Analysis & Prevention, Vol. 39, No. 3, pp. 546-555.
- Persaud B.N., R. Retting, P. Garder and D. Lord (2001) Observational before-after study of U.S. roundabout conversions using the empirical Bayes method. *Transportation Research Record 1751*, pp. 1-8.

9. Network Screening and Diagnosis (Identification of Hazardous Sites) (1 week)

Key Topics: Methods for identifying deviant or high hazardous sites. Black Spot Analysis. Diagnosis techniques.

Material: RSM: Chapters 5 & 6, Persaud: Chapter 2.

- AAHSTO (2010) Highway Safety Manual: Chapter 4. 1st Edition. Washington, D.C.
- Miranda-Moreno, L., L. Fu, S. Ukkusuri, and D. Lord (2009) How to Incorporate Accident Severity and Vehicle Occupancy into the Hotspot Identification Process? Transportation Research Record 2102, pp. 53-60.
- Miranda-Moreno, L.F., Labbe, A., and Fu, L. (2007) Multiple Bayesian Testing Procedures for Selecting Hazardous Sites. Accident Analysis and Prevention, 39 (6), pp. 1192-1201.
- Miaou-S.P., and J. Song (2005) Bayesian Ranking of Sites for Engineering Safety Improvements: Decision parameter, Treatability Concept, Statistical criterion, and Spatial Dependence. Accident Analysis & Prevention, Vol. 37, No. 4, pp. 699-720.
- Hauer, E. (1996) Identification of Sites with Promise. *Transportation Research Record 1542*, pp. 27-32.
- Konokov, J., and B.N. Benson (2003) Diagnostic Methodology for the Detection of Safety Problems at Intersections. *Transportation Research Record 1784*, pp. 51-56.
- Hauer, E., J. Konokov, B. Allery, and M.S. Griffith (2003) Screening of Road Network for Sites with Promise. *Transportation Research Record 1784*, pp. 27-32.

10. Study Design (1 week)

Key Topics: Characteristics of different study types. Estimation of sample size. Use of appropriate statistical tests.

Material: Class Notes.

- Keppel, G. (1991) Design and Analysis: A Researchers Handbook, 3rd Ed. Prentice Hall, Englewood Cliffs, N.J.

11. Crash Modification Factors (1 week)

Key Topics: Development and application of crash modification factors (CMFs). Relevant issues and assumptions about their development and use.

Material: Research papers, Class notes

- Lord, D., and J.A. Bonneson (2007) Development of Accident Modification Factors for Rural Frontage Road Segments in Texas. Transportation Research Record 2023, pp. 20-27.
- Bonneson, J., K. Zimmerman, and K. Fitzpatrick (2005) Road Safety Design Synthesis. Report No. FHWA/TX-05/0-4703-P1, Texas Transportation Institute, College Station, TX.
- Shen, J., and A. Gan (2003) Development of Crash Reduction Factors: Methods, Problems, and Research Needs. *Transportation Research Record 1840*, pp. 50-56.
- Davis, G. (2000) Crash Reduction Factors and Causal Inference in Traffic Safety Studies: A Review. *Accident Analysis & Prevention*, Vol. 32, Vol. 1, pp. 95-109.
- Tarko, A., and S. Eranky, and K. Sinha (1998) Methodological Considerations in the Development and of Crash Reduction Factors. Presented at the 77th Annual Meeting of the TRB. Transportation Research Board, Washington, D.C.

Attendance:

Valid reason must be given for nonattendance (see TAMU policy – Section 10 of Student rules; http://student-rules.tamu.edu/rule07).

Course Evaluation:

Assignments: 40% (6-8 assignments)
Term Paper: 40% (grading criteria and due date will be provided when paper is assigned)
Class Participation: 20%

Note: This course requires the participation of the attendees. The students are expected to read assigned material beforehand and be ready to discuss it during the class.

Grading Scheme:

A = above 90%, B = 80 to 89%, C = 70 to 79%, D = 60 to 69%, F = below 60%

Academic Honesty:

"An Aggie does not lie, cheat, or steal or tolerate those who do." Student are expected to understand and abide by the Aggie Honor Code presented on the web at: http://www.tamu.edu/aggiehonor. No form of scholastic misconduct will be tolerated. Academic misconduct includes cheating, fabrication, falsification, multiple submissions, plagiarism, complicity, etc. These are more fully defined in the above web site. Violations will be handled in accordance with the Aggie Honor System Process described on the web site.

E-mail:

Communication via e-mail (questions on homework, exams, class examples, etc.) is encouraged. As much as possible, questions submitted via e-mail will be answered to the sender as soon as possible. The instructor will use the e-mail system to make any relevant notifications. E-mails may also be used to distribute clarifications on class lectures, homework, exams and problem solutions. Use of e-mail is strictly voluntary. If you would like to receive course-related e-mail, send the instructor an e-mail message, indicating your name, the course, the section, and your e-mail address.

ADA Policy:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of student Life, Services for Students with Disabilities in Room B118 of the Cain Hall Building, or call 845-1637.

Note: Any alterations about the content of the course will be discussed in class before implementation. The student is responsible for all the material presented above and covered in the textbooks, manuals and papers.

Prepared by: Dominique Lord

Date of Preparation: July 6, 2012

RECEIVED
JUL 17 2012
GRADUATE STUDIES

RECEIVED
JUN 28 2012
R. AUTENRIETH

Texas A&M University
Departmental Request for a Change in Course
Undergraduate ♦ Graduate ♦ Professional

• Submit original form and attachments •

1. Request submitted by *(Department or Program Name)*: Department of Mechanical Engineering
2. Course prefix, number and complete title of course: MEEN 667 Mechatronics

Attach a brief supporting statement for changes made to items 3a thru 3d. and 6 below.

3. Change requested
   a. Prerequisite(s): From: _____ To: _____
   b. Withdrawal (reason): _____
   c. Cross-list with: _____

Cross-listed courses require the signature of both department heads.

   d. Change in course title and description. Enter complete current course title and current course description in item 5; enter proposed course title and proposed course description in item 6. Complete item 7 for change in title.
   e. Change in course number, contact hours (lab & lecture), and semester credit hours. Complete item 7. **Attach a course syllabus.**
4. For informational purposes only, please indicate course number if this course will be stacked: MEEN 433
5. Complete current course title and current catalog course description:

6. Complete proposed course title and proposed catalog course description (not to exceed 50 words):

7. a. As currently in course inventory:

Prefix	Course #	Title (excluding punctuation)
MEEN	667	Mechatronics

Lect.	Lab	SCH	CIP and Fund Code	Admin. Unit	FICE Code	Level
03	00	03	14190100 06	1920	003632	4

b. Change to:

Prefix	Course #	Title (excluding punctuation)
MEEN	667	Mechatronics

Lect.	Lab	SCH	CIP and Fund Code	Admin. Unit	Acad. Year	FICE Code	Level
02	03	03	14190100 06	1920	12-13	003632	

Approval recommended by:

Gerald A Cohen — 6/27/12
Department Head or Program Chair *(Type Name & Sign)* — Date

Department Head or Program Chair *(Type Name & Sign)* — Date
(if cross-listed course)

Submitted to Coordinating Board by:

Associate Director, Curricular Services

Scott [illegible] — 7/11/12
Chair, College Review Committee — Date

[illegible] — 7/11/12
Dean of College — Date

[illegible] — 8-21-12
Chair, GC or UCC — Date

Date

Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8201 or sandra-williams@tamu.edu.
Curricular Services – 02/11

TEXAS A&M UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING
FALL 2011

MEEN 433/667 Mechatronics

Introduction to mechatronics; basic principles of digital logic and analog circuits in mechanical systems; electrical-mechanical interfacing; sensors and actuators; digital control implementation; precision design and system integration. Three credit hours (2-3).

Instructor:

Won-jong Kim, Ph.D.
Associate Professor
221 Engineering/Physics Building
(979)845-3645, phone
wjkim@tamu.edu, email
http://alum.mit.edu/www/wjkim, webpage

TA/Grader:

none

Lectures:

MW 10:20 AM–11:10 AM at 205 ENPH(T)

Labs:

F 10:20 AM–11:10 AM at 312 ENPH(T), instruction

Each lab consists of a 2-hour hands-on experiment following a 1-hour lab instruction. Lab attendance is mandatory.

Office Hours:

MW 12:20 PM–1:20 PM at 221 EPB or 205 ENPH(T) and
F 12:45PM–1:45 PM at 312 ENPH(T) or 221 EPB

Texts (required):

- D. G. Alciatore and M. B. Histand (AH), *Introduction to Mechatronics and Measurement Systems*, 4th Ed., McGraw-Hill, 2011 (3rd or 2nd Ed. OK).
- G. F. Franklin, J. D. Powell, and A. Emami-Naeini (FP), *Feedback Control of Dynamic Systems*, 5th Ed., Chap. 8, Prentice Hall, 2006 (4th or 6th Ed. OK)—for digital control.

We will cover Chaps. 3, 5–7, and 9–11 of AH and Chap. 8 of FP in class. Chaps. 1–2, 4, and 8 of AH are assigned to read in the first week.

References:

- M. M. Mano and C. R. Kime (MK), *Logic and Computer Design Fundamentals*, 4th Ed., Prentice Hall, 2008—for digital logic and system design.
- M. Predko (P), *Programming and Customizing PICmicro Microcontrollers*, 2nd Ed., McGraw-Hill, 2001—for labs and term project.
- P. Horowitz and W. Hill (HH), *The Art of Electronics*, 2nd Ed., Chaps. 1–12, Cambridge University Press, 1989—for analog electronics and interface.
- A. S. Sedra and K. C. Smith (SS), *Microelectronic Circuits*, 5th Ed., Chaps. 2–5, Oxford University Press, 2004—for analog electronic devices.
- B. W. Kernighan and D. M. Ritchie (KR), *The C Programming Language*, 2nd Ed., Prentice Hall, 1988—for C programming.
- G. S. May and S. M. Sze (MS), Fundamentals of Semiconductor Fabrication, Chaps. 1 and 9, Wiley, 2004—for semiconductor manufacturing.
- H. H. Woodson and J. R. Melcher (WM), *Electromechanical Dynamics*, Part 1, Chap. 4, Krieger, 1990—for electromechanics.
- I. J. Busch-Vishniac (BV), *Electromechanical Sensors and Actuators*, Chaps. 1 and 3–5, Springer-Verlag, 1999—for sensors and actuators.
- H.-D. Chai (C), *Electromechanical Motion Devices*, Chaps. 4–7, Prentice Hall, 1998—for sensors and actuators.
- A. H. Slocum (S), *Precision Machine Design*, Prentice Hall, 1992—for precision design.

Reading assignments will be given with the references. All references can be checked out for two hours from the Reserved Books Desk at Evans Library.

On-Line Course Materials:

A course web page is being established on the Blackboard Vista web site at http://elearning.tamu.edu/. You should be able to access the page if you are registered for the course. All course-related material you will need, e.g. lecture slides, handouts, homework sets, solutions, lab descriptions, other useful materials will be placed on-line in PDF format for you to download and print.

Prerequisites:

- Sophomore-level electronics (ECEN 215)
- Hands-on instrumentation labs (MEEN 260)
- Dynamic systems and controls (MEEN 364)
- Any programming language

Regarding prerequisites, I expect you to be familiar with the following topics.

Sophomore-level electronics:

- Constitutive equations for passive elements, such as R, L, and C.
- Applying KVL and KCL for circuit analysis.
- Analyzing basic RLC circuits
- Analyzing basic OP Amp circuits

Hands-on instrumentation labs:

- Using basic instruments, such as oscilloscopes, function generators, power supplies, etc.
- Designing and performing basic engineering experiments.
- Writing technically sound proposals and reports.

Dynamic systems and controls:

- Writing equations of motion and finding transfer function
- Determining system (time and frequency) responses
- Designing simple controllers (PID, etc.)
- Determining system stability

Any programming language:

- Fluency in C, Matlab, C++, Fortran, Pascal, or any assembly language (for 8051, 6811, etc.)

Course Objectives:

- Understand key contemporary issues in system integration with sensors, actuators, and real-time controllers.
- Cultivate confidence in your capability to design a microcontroller-based mechatronic system.

Course Learning Outcomes:

Upon successful completion of this course, you will be able to:

- Understand state-of-the-art microcontroller structures and their applications.
- Understand basic working principles of active electronic devices, such as BJT, FET, CMOS, and OP amp.
- Read and understand manufacturers' data sheets.
- Design combinational and sequential digital logic circuits with off-the-shelf ICs.
- Build analog and digital interface.
- Develop working knowledge in key sensors and actuators and their applications.
- Design and implement simple digital controllers.

Grading:

- Mid-term exam for 35%
- Final examination for 50%
- Homework for 15% total
- Lab attendance (If you miss a lab without university-approved excuses, 3% *of the total grade* per absence will be deducted.)
- Lab safety (See the section titled, Laboratory Safety on page 5. Upon each lab-safety violation, 1% *of the total grade* will be deducted.)

Class participation (up to 5%) will not be quantified, but may affect the final grades for those on the grade borderlines. This class participation includes participation in discussion in class and the instructor's office hours, volunteering to answer/solve problems, and asking intelligent questions to enhance the class's understanding of the course material.

Policy on Grading Complaints:

If you feel a mistake was made in grading any material involving (1) points not added or not recorded properly, (2) points taken-off for an answer that is not 100% correct, or (3) for giving partial credit, please, first talk to the person doing the grading within a week after the graded paper was distributed. If you are not satisfied with the resolution of the matter then talk to me. *After the one week discussion period, we will not review your exams or change grades.* Please make your complaint to me in writing and via e-mail. Be specific about your complaints.

Absences:

Work missed due to absences will only be excused for University-approved activities in accordance with TEXAS A&M UNIVERSITY STUDENT RULES (see http://student-rules.tamu.edulrule7.htm). Specific arrangements for make-up work in such instances will be handled on a case-by-case basis. In accordance with recent changes to Rule 7, please be aware that in this class any "injury or illness that is too severe or contagious for the student to attend class" will require "a medical confirmation note from his or her medical provider" even if the absence is for less than 3 days (see 7.1.6.2 injury or illness less than three days).

Exams:

- Mid-term exam: in class, Wednesday, November 2, 2011 at 205 ENPH(T). Materials to be covered up to and including Lecture 15 and Homework 7.
- Final exam: 3:00 PM–5:00 PM, Friday, December 9, 2011 at 205 ENPH(T). Comprehensive. Covers all lecture and lab materials.

All exams are open-book, open-note. However, *any materials authored or collected by anyone else who took or is taking this course are strictly prohibited. In addition, you may not share any materials with your classmates during the exams.* You should expect substantial design problems (in hardware and software) that require creative application of the course materials.

Term-Project Expenses:

There will be a small fund available for your term project, and you can purchase materials and supplies up to your budget that I approve. There are three methods to use this fund. (1) You yourself make an arrangement with your vendor to send the bill directly to our department with MEEN 433/667 listed as a reference or PO Number. If your vendor does not honor this request, (2) you may check out the department credit card from either Ms. Peggy McCarty at 206 EPB or Ms. Holley Toschlog at 203 EPB. This card must be returned the same day, and you cannot write down the card number for future purchases. In other words, you should check out the card each time you make a purchase. In case there is any incident of abuse, this privilege will be revoked. (3) If you have a US social security number, you may make purchases out of your pocket and get reimbursed with the original receipts within 5~7 business days. Note that TAMU will not reimburse any Texas sales tax you would pay.

The Mechanical Engineering Machine Shop located on the first floor of ENPH(T) is available for your term project. You can use the machine tools in the machine shop free of charge for the term project, if you do the labor.

Term-Project Presentations:

- Monday, December 5, 2001 at 312 ENPH(T). An approximately 15-minute time slot will be assigned to each group by random drawing.

Homework:

There will be 14 homework sets to be handed out every Monday. Each homework set is due the beginning of the class on its designated due dates. Homework sets may contain design problems (in software and hardware) to prepare you for the labs, exams and term project. Your homework must represent your own work. *No late homework will be accepted.*

Laboratory Safety:

As each student enrolled in a qualifying laboratory course at TAMU is required to sign an LSA form, each student should log onto HOWDY, select "My Record" tab, then go to the "Registration" section. From the, the student selects "Lab Safety Acknowledgment" and the proper term. This will result in a list of the laboratory safety forms for the classes in which he/she is registered that require a form. The student should read the form and click to acknowledge.

Also refer to the document titled, *Laboratory Safety: Basic Student Guideline*. You are asked to sign and return the safety contract to me by the first lab.

Tentative Grading Policy:

- A: greater than 80%
- B: greater than 60% and less than 80%
- C: greater than 40% and less than 60%
- D, F: less than 40%

To Earn Graduate Credit:

MEEN 433/667 is a stacked course. University policy FS.18.033 requires that more rigorous activities be provided for graduate students to ensure work at the graduate level. To earn the MEEN 667 credit, you should design a mechatronic system. I strongly recommend that you relate this activity to your own graduate research and/or complete a term project. You should submit a *type-written* report by 10:20 AM on Monday, December 5, 2011. The report must not exceed 10 single-spaced pages with 12-point fonts. If this report is unsatisfactory, you will be given an I grade. I will be glad to offer my guidance regarding this activity, and you are encouraged to speak with me early in the semester. If you do not feel like doing this assignment or will be too busy to complete it in time, you should change your registration to MEEN 433. An MEEN student in the G7 classification is allowed to include up to two 400-level courses in his/her degree plan.

Useful Websites:

- Textbook: http://www.engr.colostate.edu/mechatronics
- Microchip website: http://www.microchip.com
- M. Predko: http://www.myke.com
- Fairchild Semiconductor Corp.: http://www.fairchildsemi.com
- Texas Instruments, Inc.: http://www.ti.com
- MIT OpenCourseWare: http://ocw.mit.edu
- CCS C compiler: http://ccsinfo.com
- Karl Lunt's monitor program: http://www.seanet.com/~karllunt/picload.htm
- ASCII Code Table: http://www.asciitable.com or http://www.jimprice.com/jim-asc.htm
- Resistor Color Code: http://www.elexp.com/t_resist.htm

ADA Statement:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Room 126 of the Koldus Building or call 845-1637.

Academic Integrity:

Aggie Honor Code: *"An Aggie does not lie, cheat, or steal, or tolerate those who do."*

It is the responsibility of students and instructors to help maintain scholastic integrity at the university by refusing to participate in or tolerate scholastic dishonesty (Student Rule 20. Scholastic Dishonesty, http://student-rules.tamu.edu). New procedures and policies have been adopted effective September 1, 2004. Details are available through the Office of the Aggie Honor System (http://www.tamu.edu/aggiehonor/). An excerpt from the Philosophy & Rationale section states: "Apathy or acquiescence in the presence of academic dishonesty is not a neutral act -- failure to confront and deter it will reinforce, perpetuate, and enlarge the scope of such misconduct. Academic dishonesty is the most corrosive force in the academic life of a university."

Schedule:

On the next page is a tentative schedule. The pace will be adjusted as the semester progresses. There will be a lecture on Friday, September 2 at 205 ENPH(T) to compensate for the missed class on October 31. The numbers in parentheses to the right of the topics indicate the corresponding chapters of the textbook. Reading assignments are given *in addition to* corresponding textbook reading.

Wk	Monday	Wednesday	Friday (labs)
1	**Course Overview (1)** AH 1–2	**Semiconductor Electronics (3)** semiconductor physics, band theory, doping, PN-junction diode, Zener diode, light-emitting diode (LED)	No lab AH 4; P 1–2; SS 3
2	**BJT (3)** bipolar-junction transistor (BJT), BJT common-emitter operation HH 1–2.9; SS 4	**BJT Applications (3)** BJT applications for switching, semiconductor manufacturing MS 1, 9	**16F877 Overview (7)** microcontroller architecture, instruction set AH 7.1–7.4; P 3–4, 15; MK 10–12; HH 11
3	**Digital Circuits (6)** DL (diode logic), DTL, TTL (transitor-transitor logic)	**Combinational Logic (6)** number system, Boolean algebra, truth table, DeMorgan's theorem, bubble pushing, half adder, full adder	**16F877 Programming** C language, communication AH 7.7; P 5; KR
4	**Combinational Logic (6)** Karnaugh map, logic minimization, binary subtractor MK 1–5	**Combinational Logic (6)** binary parallel adder, carry look-ahead, comparator, parity generator/checker	**16F877 I/O and A/D (8)** I/O and data acquisition AH 8; P 6–7, 15; HH 9.15–9.26; MK 13
5	**Combinational Logic (6)** decoder/demultiplexer, multiplexer/data selector, encoder	**Sequential Logic (6)** timing chart, RS latch, D flip-flop (FF), JK FF, T FF, switch debounce circuits	**16F877 Interrupts** polling and interrupts P 9, 15; HH 10
6	**Sequential Logic (6)** master-slave FF, edge-triggered FF, FF with data lockout MK 6	**Sequential Logic (6)** shift register, data converter/ transmitter, binary ripple counter MK 7; HH 8	**16F877 Encoder** interface with polling and interrupts
7	**Sequential Logic (6)** synchronous counter, BCD (binary-coded-decimal) counter, counter applications	**Field Effect Transistor (FET) (3)** JFET, MOSFET (metal-oxide semiconductor FET), MOSFET switch, CMOS (complementary MOS), SS 5	**Logic Gates and FFs (6)** RS latch, D FF, JK FF, binary counter AH 7.6
8	**Large-Scale IC (6)** CMOS logic and memory, flash memory, TTL-CMOS interfacing HH 3, 9.1–9.14; MK 9, 14	**Position Sensors (9)** capacitance probe, LVDT, laser distance sensor, laser interferometer, optical encoder	**555 Timer and OP Amp** monostable and astable oscillators HH 5.12–5.20
9	**Specialty Sensors (9)** strain gauge, accelerometer, thermocouple, load cell, pyrometer S 3–4	**Electromechanical Actuators (10)** voice-coil actuator, DC motor, PM motor, stepper motor	No lab WM 4; BV 1, 3, 4–5; C 4–7
10	**Smart-Material Actuators (10)** piezoelectric, magnetostrictive, ionic-polymer actuators	**Analog Signal Processing (5)** voltage regulator, OP amps, differential amplifier, instrumentation amplifier, anti-aliasing filter, active filter HH 2.15–2.25, 4, 5.1–5.11, 6–7	**16F877 Interface** interface with temperature sensor, IR (infrared) range sensor, and solenoid valve/relay
11	**Analog Signal Processing (5)** low-frequency amplifiers, pulse-width modulation (PWM) amplifier, ground-loop elimination AH 7.8–7.9; P 6; HH15	**Discrete-Time Systems (FP 8)** difference equation, Z-Transform	**16F877 PWM** PWM, DC motor driving P 6
12	**Digital Control (FP 8)** design by emulation, digital PID and lead-lag compensators	**Digital Control (FP 8)** root locus, zero-order-holder (ZOH) equivalence	**DC Motor Control** digital controller design and implementation
13	**Real-Time Control (FP 8)** real-time control implementation	**Mechatronic Systems (11)** precision design, interfacing, sensor mounting. S 1–2	No lab, Thanksgiving
14	**Mechatronic Systems (11)** control architecture, system integration. S 5, 7	**Term-Project Prep.** P 15–16; HH 12	**Term-Project Prep.**

MEEN 433/667 Mechatronics

Fall 2011

Instructor: Prof. Won-jong Kim

Questionnaire

Name:

Email address:

Phone number:

TAMU ID:

TAMU Department:

Are you a senior, a master's student, or a doctoral student?

Advisor (if applicable):

Have you taken ECEN 215 (or equivalent)?	Yes.	No.
Have you taken MEEN 260 (or equivalent)?	Yes.	No.
Have you taken MEEN 364 (or equivalent)?	Yes.	No.

What would you like to learn from this course?

Will the course materials be useful for your research? If so, please tell me about your research briefly.