ISEN 434: Human Error and Complex System Failures
ISEN 689: Special Topics in Human Error and Complex System Failures
Fall 2017

Course Info:
Lectures: 3:55 – 5:10, Tuesdays and Thursdays
Lecture room: 3024 ETB (http://aggimap.tamu.edu/?bldg=0270)

Instructors:
Thomas Ferris, PhD
Office: 4081 ETB
Contact (email preferred): tferris@tamu.edu; 979-458-2340
Office Hours: Thursdays 2:00 – 3:30 or by appointment

Nancy Currie-Gregg, PhD
Office: 4080 ETB
Contact: currie-gregg@tamu.edu
Office Hours: Tuesdays 2:00 – 3:30 or by appointment

Abhinav (“Abhi”) Bhardwaj, ISEN Teaching Assistant
Office: 4050 ETB, Desk #39
Contact: abhinavb@tamu.edu
Office Hours: Mondays 2:00 – 3:30 or by appointment

Text:
All course materials will be hosted on eCampus: http://eCampus.tamu.edu/

Scope and Objectives:
This course introduces human error from a sociotechnical systems perspective, analyzes the role of error in complex system failures. Models of human error will be presented and characterized according to how errors emerge from human behavioral modes and other system design factors; analytical methods for defining the roles and impact of errors in large-scale system accidents. The course will draw heavily on real-world case studies from several application domains (Challenger, Three Mile Island, Therac-25, Bhopal, Titanic, etc.). Design strategies for reducing the likelihood of error occurrence and mitigating error consequences will also be introduced and applied to the case studies. Prerequisites for ISEN 434: ISEN 330 or instructor permission

ISEN 689 is for graduate student enrollment in a course that will share a lecture with the undergraduate technical elective ISEN 434. Graduate students will be assigned to separate project groups and will serve as the primary points of contact between groups and instructors. 689 students may also be assigned additional reading assignments and responses that are not required of the 434 students. 689 students will also be expected to deliver a separate assessment at the conclusion of the semester which will require a report on how the lessons
learned from the course can apply to their research or work backgrounds (see the “Lessons learned report” section below). Prerequisites for ISEN 689: graduate standing and instructor permission

Learning Outcomes:
Students will be able to...

- Understand the unique and interacting roles of different cognitive functions influencing human information processing, decision making, and action
- Identify human behavioral modes, and the strengths and limitations of operating in these modes
- Categorize error according to Reason’s error classifications
- Analyze an accident to determine sources of error and their impact on system failure trajectories
- Provide system design recommendations to build resiliency into the systems by reducing error likelihood, aiding in recovery, and mitigating error consequences
- Demonstrate an in-depth knowledge of design and human factors that contributed to high-profile real world accident case studies

Grade Determination:

30% Homework and quizzes
30% Midterm exam
40% Semester project

Grades will be calculated on the basis of total points earned, with one exception as noted below. The points can be curved based on class average and may be lower than the following standard:

A: 90-100%  B: 80-89%  C: 70-79%  D: 60-69%  F: 59% and lower

Homework and Quizzes:

There will be approximately one homework assignment released per lecture topic, designed to give you practice in applying principles and ideas learned in the course. Some but not all of the homeworks will be graded (the instructor will specify when they are graded). Ungraded homeworks will be provided so you can work through the problems in preparation for graded quizzes and exams.

Homework assignments and solutions (when appropriate) will be posted on eCampus and announced in lecture and/or via email. Due dates for each assignment will be given when they are issued, but will generally be within 1 week. Completed assignments will be submitted electronically via eCampus (in Word or pdf format). Quizzes will be conducted during lecture, either via eCampus or on paper. The total homework/quiz grade will be based on total points, not on the average of percentage grades for each entry.

Generally, assignments that are submitted after the due date/time will not receive any credit.

Exceptions can be made in case of sickness, military service, jury duty, presentation at a professional conference, or death in the family. In all of these cases, some form of documentation will be required.

Exam:

There will be one midterm exam worth 30% of the overall course grade, tentatively scheduled for Week 8 of the semester. Format for the exam is TBD but will use some combination of eCampus and written format. The exam will emphasize material discussed in lecture and practiced in the homework, and can include
quantitative problems, short answer questions, and/or essays. Grades will be posted on the course eCampus website and students can review their graded exams during office hours.

Exam dates will be flexible only in case of sickness, military service, jury duty, presentation at a professional conference, or death in the family (documentation required in all cases).

Semester project:

This course includes a semester-long group project to analyze and present an in-depth case study of a high-profile historical system accident. Work related to this project accounts for 40% of the overall course grade. Example project topics include the sinking of the Titanic, Chernobyl nuclear disaster, Deepwater Horizon oil spill, NASA Challenger accident, the Texas City fertilizer plant explosion, or the September 11th terrorist attacks. 10-12 groups of students will be formed by the instructor, and each group will begin researching a topic of their choice early in the semester. With various deliverables throughout the course, groups will analyze their accidents according to learned techniques, and come up with redesign solutions to prevent similar accidents from happening in the future. In addition to submitting a final written report, the final six weeks of class will involve student groups presenting their case studies to the class.

Lessons learned report (ISEN 689 students only):

Each graduate student will be individually responsible for submitting a report at the end of the semester detailing how the methods and/or case histories learned in the course are applicable to problems in their own research or work endeavors. Students will be encouraged to include references to human error modes and designing for human error, as well as applying quantitative and qualitative human reliability and accident analysis methods. Format for this report is TBD, but will build upon the final written report completed with their semester project group.

Re-grading Policy:

Students have 1 week after grades are released for a homework, quiz, or exam to submit a re-grade request in writing. This request must not exceed 1 page (11 point font, single spacing), and must clearly indicate the relevant problem(s) and justification for why you think re-grading is warranted. Note that a requested re-grade may result in further point deductions if new errors are discovered.

Attendance:

Students are expected to attend all class lectures except for university-excused absences (see http://student-rules.tamu.edu/rule07 for more information), and it is the student’s responsibility to contact course instructors or teaching assistants to make up missed assignments and quizzes within 1 week of returning from the university-excused absence, as well as to submit the required documentation.

Academic Integrity and Misconduct Policy:

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”

Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning and to follow the philosophy and rules of the Honor System. Ignorance of the rules does not exclude any member of the Texas A&M University community from the requirements or the processes of the Honor System. For additional information please visit: http://student-
Per ISEN departmental policy, any unauthorized collaboration with current or past students for course work will receive an automatic F* in the class, with no exceptions. This denotes an F grade for reasons of academic misconduct. The case will also be reported to both the ISEN department and the Aggie Honor System Office, which may result in further punishment including expulsion. While collaboration for regular homework and discussion about the course among classmates is encouraged and expected, collaboration (e.g., sharing answers or discussing strategies) in quizzes, exams or other individual assessments is strictly forbidden.

**Americans with Disabilities Act (ADA)**

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 Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit [http://disability.tamu.edu](http://disability.tamu.edu).

**Tentative Schedule (Subject to Change!)**

Any substantial changes will be announced in class/via email and an updated schedule will be available on eCampus. **Note:** homework, quizzes, and Writing deliverables due dates will be given when each is issued.

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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to humans and sociotechnical systems, example case study: NASA’s Columbia accident</td>
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<td>2</td>
<td>Human factors: perception, attention, decision making, physical factors and safety</td>
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<td>3</td>
<td>Human behavioral framework (Rasmussen’s Skill-, Rule-, Knowledge-based behavioral modes)</td>
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<td>4</td>
<td>Human error and error modeling (Reason’s classifications), Human Reliability Assessment</td>
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<td>5</td>
<td>Error as a system property/design-induced error, Error analysis methods</td>
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<td>6</td>
<td>Survey of historical and current accident models, role of error in accident analysis</td>
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<td>7</td>
<td>Normal Accident Theory and Systems Safety models; Resilience Engineering and High-Reliability Organizations</td>
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<tr>
<td>8</td>
<td>Midterm review, Midterm exam</td>
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<tr>
<td>Weeks 9 – 14</td>
<td>Student groups present case studies</td>
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