Course Name: RISK AND RELIABILITY ANALYSIS IN DESIGN (RISK BASED DESIGN)
Course Number: ME 515
Course Credits: 4 hours, includes 4 hours/week lectures
Prerequisites: None. Graduate Standing.

Instructor:
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Course Description:
Fundamentals of risk, uncertainty, and reliability. Methods to analyze and quantify the risk of failures, and the reliability of complex systems, including fault tree analysis, reliability block diagrams, probabilistic risk assessment. Introduction to research methods for risk and reliability analysis during the early design stages.

Learning Outcomes:
By the completion of this course, students will be able to:
- Articulate risk and reliability concepts
- Apply standard risk analysis methods to large systems
- Explore failure and risk databases
- Formulate a research problem and present findings and research approach

Textbook:
No textbook is assigned. Reading assignments will be handed out for selected topics either from published articles or books. Suggested books for reading include:
- Probabilistic Risk Assessment: Reliability Engineering, Design, and Analysis
- Reliability engineering: Modeling, Prediction, and Optimization

Grading:
- Homework (individual & teams) 30%
- Midterm Exam 30%
- Research Project 40% (Research proposal 5%, interim presentation 5%, final report 20%, oral presentation 10%)

Homework Assignments:
- Implementation exercises on selected system (discuss system with instructor) (teams)
  - Selection of an example system, looking up databases, list of potential failures, risks from published databases, FMEA, FTA, Use of design repository
- 1-page summary and in-class discussion of reading assignments (individual; 3 papers)

Research Project:
Expectations from research project:
- Literature search on selected topic; a thorough discussion and analysis of the state-of-the-art and existing gaps/needs; discussion of how system used for HW assignments could be improved using research ideas (or selected approach); a plan of research approach.
- Deliverables: proposal, interim presentation, final report and presentation

Possible Research Topics (discuss topic with instructor, 1st week!)
- Failure modeling; Probabilistic design; Uncertainty analysis; Risk based design; Reliability modeling; Decision based design

Special Needs:
Students with documented disabilities who may need accommodations, who have any emergency medical information the instructor should know of, or who need special arrangements in the event of evacuation, should make an appointment with the instructor as early as possible, no later then the first
Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098.

Academic Integrity:
Academic dishonesty is prohibited and considered a violation of the OSU Student Conduct Regulations. It includes cheating, the intentional use of unauthorized materials, information, or study aids; fabrication, assisting in dishonesty or tampering (intentionally or knowingly helping or attempting to help another commit an act of dishonesty or tampering with evaluation instruments and documents); and plagiarism, intentionally or knowingly representing the words or ideas of another person's as ones' own. If you have a question regarding academic integrity, please talk to the instructor or refer to the OSU student conduct homepage at http://osu.orst.edu/admin/stucon/index.htm.

Topics and Approximate Schedule:

Week 1: Basic Concepts
Basic concepts and definitions: Risk vs. Reliability, Hazards, Failures, Uncertainty sources
Selection of research project topic
HW1: Reading assignment

Week 2: Reliability Engineering
Traditional design; Safety Factors; Probabilistic Design
Reliability engineering; Reliability measures; Reliability block diagrams
RP1: Research proposal
HW2: Reliability Measures and reliability block diagram

Week 3: Failure Definitions and Failure Databases
Failure: definitions and modeling (HW vs SW failures; component vs system-level failures)
Failure and Reliability Databases
HW3: Select system, list failures & provide example of a failure or reliability data for selected system

Week 4: Risk Analysis Methods
Failure modes and effects analysis (FMEA), Criticality analysis (CA)
HW4: Generate FMECA for selected system

Week 5: Risk Analysis Methods
Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Probabilistic Risk Assessment (PRA)
HW5: Generate FTA for selected system and compare to FMECA results

Week 6: Risk Based Design (RBD)
Midterm Exam (basic concepts and definitions in risk based design, failures, uncertainty, probabilistic design, reliability measures, and exercises in FMECA, FTA, databases, reliability block diagrams)
Risk based design: risk considerations in early design stages

Week 7: RBD Research Methods
Failure analysis during functional design (FFDM)
Design repository
HW6: Use of design repository for selected system
RP2: Interim progress presentations due this week (10 minutes)

Week 8: RBD Research Methods
Functional failure identification and propagation (FFIP)
HW7: Reading assignment
Week 9: RBD Research Methods
Cost-benefit analysis (CBA)
Course summary

Week 10: Research Presentations
RP3: Project presentations due this week (20 minutes)
RP4: Final project reports due.