**ASTE 528: Reliability of Space Systems**

**Course Description:**

This course provides engineering and science students with the tools and techniques necessary for reliable system design and operations. The students will be encouraged to think of the concepts of reliability and risk as measures of performance of a system and within the context of the system design, development and operational lifecycle. The course will cover 1) the basic concepts and analytical methods of Systems Reliability Theory 2) Probabilistic Risk Assessment and its application to space systems and 3) The failure behaviors of modern flight computer based systems and 4) Empirical methods and reliability centered maintenance. The course textbook will be supplemented with papers that describe the application of risk and reliability engineering to space systems.

The course project (individual) will provide students with an opportunity to study and formulate an example reliability and risk assessment problem of their choice and each student will be required to prepare an initial problem formulation/proposal for their project after the midterm and then a short final report.

**Topics:**

* Introduction to Reliability & Risk Engineering
* Review of Probability
* Failure Models
* Fault Tree Analysis
* Markov Models
* Component Importance and Sensitivity Analysis
* Probabilistic Risk Assessment
* Reliability Engineering for Computer Based Systems
* Bayesian Belief Networks
* Review of Statistics
* Data Analysis for Reliability Engineering
* Reliability Centered Maintenance

**Textbooks:**

Marvin Rausand and Arnlgot Hoyland, System Reliability Theory: Models and Statistical Methods, Wiley-Interscience; 2nd edition

**Other Material:**

“Fault Tree Handbook with Aerospace Applications”

By: M. Stamatalatos, et. al, to be available online

“NASA Probabilistic Risk Assessment guideline” to be available online

Additional papers and reading material will be provided to students during the class.

**Course Requirements and Grading:**

|  |  |
| --- | --- |
| **Requirement** | **Total Points** |
| Homework | 30 |
| Midterm Exam | 25 |
| Project | 20 |
| Final Exam | 25 |
| Total | 100 |

**Schedule:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Session** | **Date** | **Class Topic** | **Reading Assignment** |
| 1 | tbd | Introduction to Reliability & Risk Engineering | Chapter 1 |
| 2 | tbd | Failure Models | Chapter 2, other |
| 3 | tbd | Failure Models | Chapter 2, other. |
| 4 | tbd | Fault Tree Analysis | Chapter 3, other |
| 5 | tbd | Fault Tree Analysis, continued | Chapter 4 |
| 6 | tbd | Markov Models | Chapter 6 |
| 7 | tbd | Component Importance and Sensitivity Analysis | Chapter 5 |
| 8 | tbd | Midterm | Chapter 12 |
| 9 | tbd | Probabilistic Risk Assessment | PRA reference document |
| 10 | tbd | Reliability Engineering in Computer Systems | PRA reference document |
| 11 | tbd | Review of Statistics/ Data Analysis for Reliability Engineering | lecture notes |
| 12 | tbd | Review of Statistics/ Data Analysis for Reliability Engineering | lecture notes |
| 13 | tbd | Bayesian Reliability Analysis | Chapter 11 |
| 14 | tbd | Project Presentations |  |
| 15 | tbd | Project Presentations |  |
| 16 | tbd | Final Exam |  |

Instructor: Prof. Leila Meshkat

[meshkat@usc.edu](mailto:meshkat@usc.edu)

**Academic Integrity:**

*“The Viterbi School of Engineering adheres to the University's policies and procedures governing academic integrity as described in SCampus. Students are expected to be aware of and to observe the academic integrity standards described in SCampus, and to expect those standards to be enforced in this course”.*

Disability Accommodation

*"Any Student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. - 5:00 p.m., Monday through Friday. The phone number for DSP is (213)740-0776”.*