<div align="center">**SYLLABUS**</div>

SAE 542: Advanced Topics in Systems Engineering   **Fall 2017**

<u>**Class Session:**</u> Thursday, 6:40 PM – 9:20 PM PDT, RTH 115

<u>**Contact Information:**</u>

Instructor: Dr. Phan Phan   Instructor: Mr. Kenneth L. Cureton
Office hours: D2L Discussion Board   Office hours: Thursdays 3 PM – 5 PM
Office location: D2L Web Portal   Office phone: (213) 740-1713
E-mail: Pphan@usc.edu   E-mail: Cureton@usc.edu

If you have any questions and difficulties with understanding course materials, please post any technical or administrative inquiry on our class' weekly discussion board that can benefit all fellow students (and also help us not have to answer the same questions again and again). If your inquiry is of personal nature, please e-mail us. The usual turn-around time for either discussion board or email response is 24 hours. If you don't hear from us within that timeframe, please send us a reminder. Always include both instructors in any email you send.

<u>**Course Learning Objectives:**</u>

■   As the course title suggests, various advanced topics will be covered to provide students with analytic and rigorous methodologies for critical consideration and performance of systems engineering activities.

■   Course topics are organized into three (3) major themes (related but not necessarily of systematic progression):

   a.   Probability Theory & applications in system testing & evaluation, test design, assessment of test accuracy and fidelity

   b.   Constraint Theory as an enabling tools set to manage system requirements and modeling of complex systems

   c.   Complexity Theory.

<u>**Readings and Notes:**</u>

■   Weekly lecture notes will be posted on the Desire to Learn (http://www.courses.uscden.net)
■   Required text to be acquired by students:
   •   Friedman, George J. & Phan Phan (2017). *Constraint Theory, Multidimensional Mathematical Model Management*, 2nd edition. New York, NY: Springer.

   •   Blanchard, Benjamin S. & Wolter J. Fabrycky (2006). *Systems Engineering and Analysis*, 5th edition. Upper Saddle River, NJ: Prentice-Hall.

■   Required text to be downloaded from Desire2Learn by students:
   •   Moffat, James. *Complexity Theory and Network Centric Warfare,* The DoD Command & Control Research Program (CCRP) publication (September 2003) ISBN 1-893723-11-9.

<u>**Class Grade:**</u>

Your grade will be based on two (2) exams. Both exams will be administered online through Desire2Learn, and each exam will account for 1/2 of your final grade. Homework exercises will be assigned but not graded. Their solutions will be subsequently provided to enable your knowledge check.

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Exams:

■ The exams will consist of multiple questions that will test students' knowledge about the advanced systems engineering topics presented in the class. These exams will cover the six lectures and assigned readings prior to the exam (the exams are not cumulative). These will be open book, take-home exams over a four-day period. The mid-term exam can be downloaded, completed, and submitted to Desire2Learn anytime between **Friday September 29, 2017 6:00 AM PDT and Monday October 2, 2017 11:59 PM PDT**. The final exam can be downloaded, completed, and submitted to Desire2Learn anytime between **Thursday December 7, 2017 6:00 AM PST and Sunday December 10, 2017 11:59 PM PST**. All times are in the Pacific time zone.

■ You *are **not** allowed* to collaborate on the exams. You *are **not** allowed* to copy-and-paste from the readings, publications, any other Internet sources, or the course materials-- all exam answers must be in your own words. The default punishment for unauthorized collaboration, cheating, and plagiarism on the exams is a grade of F for the course.

UNIVERSITY LEVEL ISSUES

■ **Statement for Students with Disabilities**:
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 GFS 120 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

■ **Statement on Academic Integrity**:
USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus,* the Student Guidebook, contains the Student Conduct Code in Section 13.00, while the recommended sanctions are located in Appendix A: https://scampus.usc.edu/university-student-conduct-code/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

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<u>**Schedule of Class Sessions:**</u> The exact schedule is subject to change. Dates of readings may change to align with other schedule adjustments. Changes will be announced.

2017	Lecture Topics	Readings, homework & exams
Aug 24	1. Course intro & admin (Cureton & P2), Introduction to probability theory (P2)	HW set #1 assigned *Student biography assigned*
Aug 31	2. Imperfect testing, Review HW set #1 answers (P2)	HW set #2 assigned
Sep 7	3. Discrete & continuous probability models, Review HW set #2 answers (P2)	*Submit student biography* HW set #3 assigned
Sep 14	4. Introduction to reliability & maintainability, Models of failure rate & reliability, Review HW set #3 answers (P2)	HW set #4 assigned
Sep 21	5. Reliability & Life Testing, Review HW set #4 answers (P2)	HW set #5 assigned Read: Constraint Theory, Chapter 1; CT 1st ed, Chapter 7 or CT 2nd ed, Chapter 8
Sep 28	6. Intro to Graph Theory & Constraint Theory Review HW set #5 answers (P2 - pretaped)	
Sep 29 Oct 2	*Take-home Mid-term exam covering lecture topics and homework sets 1 through 5*	*Friday September 29 @ 6:00 AM PDT through Monday October 2 @ 11:59 PM PDT*
Oct 5	Review Mid-term Solutions (P2) 6a. Constraint Theory: Motivations (cont'd)	HW set #6 assigned Read: Constraint Theory, Chapters 2 & 3
Oct 12	7. Constraint Theory: The 4-Fold Way Constraint Theory: General Results Review HW set #6 answers (P2)	HW set #7 assigned Read: Constraint Theory, Sections 4.1 – 4.5; CT 1st ed, Sections 4.8 – 4.11 or CT 2nd ed, Sections 5.1 – 5.3, 5.8
Oct 19	8. Constraint Theory: Regular Relations Review HW set #7 answers (P2)	HW set #8 assigned
Oct 26	9. Systems Engineering for Complex Systems: Introduction to Complexity Theory (Cureton) Review HW set #8 answers (P2)	Read: Complexity Theory Chapters 1 - 2
Nov 2	10. Systems Engineering for Complex Systems: Complexity Theory Applied to Software-Intensive Systems (Cureton)	HW set #9 assigned
Nov 9	11. Resilience Engineering Concepts applied to Complex Systems (Cureton)	HW set #9 updated Read: Complexity Theory Chapter 4
Nov 16	12. Engineered Resilient Systems – Case Study of Complex Systems (Cureton)	HW set #9 updated
Nov 23	*Thanksgiving Holiday – No Class Session*	None
Nov 30	13. Research Frontiers, Advances in Constraint Theory (P2 & Cureton) Review HW set #9 answers (Cureton)	None
Dec 7 Dec 10	*Take-Home Final Exam covering lecture topics 6 through 12 and homework sets 6 through 9*	*Thursday December 7 @ 6:00 AM PST through Sunday Dec. 10 @ 11:59 PM PST*