



George Mason University
SYST 508: Complex Systems Engineering Management
Asynchronous Distance Learning
3 credit hours

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Course Syllabus

This syllabus is the agreement between you, the student, and me, the professor. Please read it carefully.

Course Goals and Objectives: This course is aimed at Master's-level students in Applied Information Technology. It develops and broadens their understanding and appreciation of both technical and non-technical aspects of systems engineering. In particular, the course introduces the students to the organizational, economic, technological and societal factors (POETS) that apply to the development of large-scale, complex mega-systems, and shows the students that "one size does not fit all" when it comes to the project management of mega-systems. At the conclusion of this course, students should be able to exhibit leadership thinking about systems (not just how but why systems are built), account for circumstances that warrant different approaches to mega-system development, be able to recognize which processes need to be tailored, and be able to explain how to do so.

Methodology: This course is delivered in a *distance learning (DL) asynchronous online mode* using the Blackboard course management tool as the primary means for accessing and delivering the course material. Because the course will be delivered asynchronously, students may access the course at any time, though assignments will be due by the end of the assigned week. The course will consist of a combination of narrated lectures, individual readings of chapters, articles and books, online discussions and team projects. In a typical week, the students will view the narrated lecture and record their questions / comments in the individual course Journal; and read a textbook chapter and/or article, then discuss the questions in the relevant Discussion Board.

Students will read and review one book on complex systems from a list provided in the book review assignment folder, or choose another book, subject to my approval. Students will create a narrated presentation which will be viewed and discussed by the in the relevant Discussion Board.

Students will form into small teams (3-5 members) at the beginning of the course, and select a system that they will examine in four separate but linked project assignments carried through the semester. A key aspect of this course is teamwork. It is the norm not only within a project team but between the team and its external stakeholders. Teams will create narrated presentations which will be viewed and discussed by the class in the relevant Discussion Board.

As with almost all graduate courses, you should expect to spend at least two hours of coursework per week for every credit hour. You should therefore not be surprised to spend at least six hours per week on your SYST 508 assignments.

Prerequisites: None

Grading (Note that there are **no** quizzes, midterm or final):

| | | | |
|---|-----|---|-----|
| Homework: | 20% | Book Review and Presentation: | 20% |
| Participation (journal, discussion boards): | 20% | (5% preview, 10% final report, 5% presentation) | |
| | | Team Projects (10% per project): | 40% |

| Letter Grade | Grade Point | Remark |
|--------------|-------------|----------------|
| A+ | 4.00 | Excellent |
| A | 4.00 | Excellent |
| A- | 3.67 | Excellent |
| B+ | 3.33 | Good |
| B | 3.00 | Good |
| B- | 2.67 | Good |
| C+ | 2.33 | Competent |
| C | 2.00 | Competent |
| C- | 1.67 | Unsatisfactory |
| D | 1.00 | Unsatisfactory |
| F | 0.00 | Failing |

Course Participation: You are expected to use the course Journal to record your comments and questions regarding narrated lectures. You are required to participate in the Discussion Boards pertaining to homework readings, book reviews and team presentations.

Textbook and Course Materials: The course textbook is *Engineering Mega-Systems: The Challenge of Systems Engineering in the Information Age* by Renee Stevens (Boca Raton: CRC Press, 2011: ISBN: 978-1-4200-7666-0). Please have this book by Week 4.

Students will use the GMU Library or other library resources for books to review, and for performing group research and presentations.

I will provide all other readings for course assignments on Blackboard system.

Course Schedule and Assignments

| Week | Topics | HW to be completed | Student Activities |
|------|--|--|---|
| 1 | Course Introduction | None | Lecture: Introduction and course objectives; Setting the context |
| 2 | Systems and Mega-Systems | Johnson , “Three Approaches to Big Technology” Sato, “Local Engineering and Systems Engineering” Select book for review | Lecture: Systems engineering; POETS; mega-systems; tame versus wicked Discussion board: HW readings Form teams and select case system |
| 3 | Stakeholder Requirements and System Concepts | Ibsen, “Boeing vs. Airbus” | Lecture: Stakeholder requirements. System concepts. Team project assignment 1: Identify key stakeholder expectations, create system concepts, downselect to one concept. Due Week 5 Discussion board: HW reading |

| Week | Topics | HW to be completed | Student Activities |
|------|--|--|---|
| 4 | System Requirements and Tradeoff Studies | Balbi, “Italian Broadcasting” Book review preview | Lecture: System requirements. Tradeoff studies Discussion board: HW reading Discussion board: book review previews |
| 5 | System Architecture and Use Schematics; Team Presentation 1 | Fletcher, “Minitel” Team Project Presentation 1 | Lecture: Systems architecture; Concept of operations and use schematics Discussion board: Team project presentation 1: Stakeholder requirements and system downselect Team project assignment 2: Develop graphics-based use schematic of selected system. Due Week 7 Discussion board: HW reading |
| 6 | Technical Reviews, Test and Evaluation | Light, “When Computers were Women” | Lecture: Technical Reviews. Test and Evaluation Discussion board:: HW reading |
| 7 | Mega-System Concepts; Team Presentation 2 | Stevens <i>Mega-Systems</i> : - Ch 3. Mega-System Concepts - Ch. 4. Framework Team Project Presentation 2 | Lecture: Mega-system concepts Discussion board: Team project presentation 2: Graphics-based use schematic |
| 8 | The System Profiler in Context | Stevens <i>Mega-Systems</i> : -Ch. 5 Engineering Mega-Systems Chs. 7 & 8 Case Studies: Single Integrated Air Picture Electronic Product Code | Lecture: The System Profiler in Context Discussion board: Using the system profiler in the SIAP and EPC case studies |
| 9 | The System Profiler in Action | Team Exercise: Integrated Electronic Health Record | Lecture: The System Profiler in Action Discussion board: Integrated Electronic Health Record Team project assignment 3: Build ‘tame’ and ‘wicked’ system profiles of selected system and use scenario. Due Week 12 |
| 10 | Observations from Case Studies; Student Book Reviews | Stevens <i>Mega-Systems</i> : -Ch 9 Observations from case studies Submit individual book reviews | Lecture: Observations from case studies |
| 11 | Systems Thinking; Student Book Review Presentations | Submit book review presentations | Lecture: Systems Thinking Discussion board: Book review presentations |
| 12 | Mega-System Challenges; Team Presentation 3 | Stevens <i>Mega-Systems</i> : -Ch 10 The Way Ahead Team Project Presentation 3 | Lecture: Mega-System Challenges Discussion board: Team project presentation 3: “Tame” and “wicked” system profiles Team project assignment 4: Re-visit team assignments 1 and 2 (revised stakeholder requirements, system downselect and use schematic) based on “wicked” system profile results. Due Week 14 |
| 13 | Decision-Making Under Uncertainty | Hansson, “Safe Design” <i>Challenger</i> Case Study <i>Columbia</i> Case Study | Lecture: Decision-making Under Uncertainty Discussion board:: HW readings |
| 14 | Team Presentation 4 | Team Project Presentation 4 | Lecture: Engineering: Lone or social activity? Discussion board: Team project presentation 4: Stakeholder requirements, system downselect and use schematic after analysis of system profiler |

Due dates: All assignments (homeworks, book reviews, team projects) for that week are due by the last day of that week – for example, the Week 2 homework is due before the Week 2 Saturday at 11:59pm.

All Lecture Journal and Discussion Board entries must be posted by the last day of the following week - for example, the Week 2 Journal and Discussion Board entries are due before the Week 3 Saturday at 11:59pm.

Lectures: Weekly lectures are provided as narrated presentations either in MP4 format or in PowerPoint. Please review them prior to working on homework assignments.

Lecture Journal entries: The Blackboard Journal is a self-reflective tool for students. Each lecture will have a corresponding Journal topic, and is visible to everyone. You are expected to use the course Journal to record your comments and questions regarding the narrated lectures, to which other students and the instructor may also comment and reply. These journal entries will count towards your course participation grade.

Homework submissions: Each reading selection will be accompanied by a list of reading questions in a separate Word document. You are to complete SHORT BUT COMPLETE (2-3 paragraphs each) answers to each of these questions and submit them using Blackboard. You will be graded on: critical thinking in answering the questions; your use of SPECIFIC examples from the readings and from other sources (which I strongly encourage you to use) in order to support your arguments; and the clarity of your writing, which includes proper spelling, punctuation and grammar. .

You will submit all your homework on Blackboard using any supported format (MS Word, PDF, etc.). Please label the file with YOUR last name and week number, as follows: LASTNAME-WEEK X. And PLEASE use the spell-check and grammar check before submitting the work – good engineering requires good writing skills (I encourage you to visit GMU's Writing Center: writingcenter.gmu.edu). I will review the document, add my comments and grade, and then post it back to you via Blackboard.

Homework Discussion Board: The Blackboard Discussion Board is a means for exchanging ideas on a topic. Each homework will have a corresponding Discussion Board topic and discussion question, and is visible to everyone. You are required to participate in the group discussions pertaining to class readings, both to initiate discussion threads and reply to others. These Discussion Board entries will count towards your course participation grade.

Independent Book Review: Students will read a book from the class reading list, which is in the SYST 508 book review list file in the Blackboard book review assignment folder. You may also select another, relevant book subject to my approval. You will write a review of the book and present the main points. You will make selection by Week 2, submit the short (2-minute) narrated preview in Week 4, submit the review in Week 10, and submit the narrated presentation in Week 11.

In order to make certain that the entire class benefits from the wide selection of books (that is, to make sure that we don't get two or three people reading and presenting the same book), I ask the students to provide me a rank-order list of their preferred books, from 1st to 4th place. I will make every attempt to assign you your top choice. Once again, you may choose another, relevant book subject to my approval.

You may choose to purchase the book, check the book out from the GMU Library or use GMU's Interlibrary Loan (ILL) system. If you are a resident of one of the local counties (e.g., Fairfax, Loudon, etc.), you may also use your local county library (including ILL).

Your 2-minute narrated preview in Week 4 will follow the template provided.

You will complete, by Week 10, a 3-5 page (single-spaced) review of the book, with the following: a) summary of book; b) theses and main points; c) specific lessons regarding engineering systems and complexity related to politics, organization and economics and society. You will also submit a 10-15 minute narrated presentation in Week 11 (template is provided).

Independent Book Review Discussion Board: In addition to submitting for grading both your 2-minute narrated preview (Week 4) and your 10-15 minute narrated presentation (Week 11), you will also post them to the corresponding Book Review Discussion Board. You are required to view and substantially comment upon each other's' preview and presentation, and reply to the questions posed by your fellow students. These Discussion Board entries will count towards your course participation grade.

Team Projects: Students will form into small teams (3-5 members) at the beginning of the course, and select a system that they will examine in four separate but linked project assignments carried through the semester. The project assignments will build one upon the other to create different products required during the early part of a systems design. See the "Team project notes" in the Blackboard Team project 1 assignment folder for the step-by-step instructions, list of case systems and team project schedule. A summary is here:

- Team project assignment 1 (start Week 3, due Week 5): Identify key stakeholder expectations.
- Team project assignment 2 (start Week 5, due Week 7): Develop graphics-based use schematic of selected "tame" system
- Team project assignment 3 (start Week 9, due Week 12): Build "tame" and "wicked" system profiles of selected system and use schematic.
- Team project assignment 4 (start Week 12, due Week 14): Re-visit team assignments 1 and 2 (revised stakeholder requirements, system downselect and use schematic) based on "wicked" system profile results.

Team Project Discussion Board: In addition to submitting each narrated team presentation for grading, teams will also post them to the corresponding Team Project Discussion Board. You are required to view and substantially comment upon each other's' presentations, and reply to the questions posed by your fellow students. These Discussion Board entries will count towards your course participation grade.

Course Weekly Schedule: Please see the SYST 508 weekly schedule file in the Syllabus folder.

Contacting me: My preferred method of contact is e-mail, and I will usually reply quite promptly. If you need to reach me right away, my telephone contact numbers are at the front of the syllabus (please use my work number, but if something is even more urgent call my cellphone).

Administrative Notes:

- Technology requirements, instructions, and guides for accessing Blackboard may be found at: <http://courssupport.gmu.edu/Students/>.
- Students must be aware of their own and others' privacy rights, explained here: <http://registrar.gmu.edu/students/privacy/>
- Students must follow the guidelines of the University Honor Code. See <http://oai.gmu.edu/the-mason-honor-code-2/> for the full honor code.
- Students must follow the university policy for Responsible Use of Computing. See <http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/>
- Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See <http://ods.gmu.edu/>].
- Students are responsible for the content of university communications sent to their George Mason University email account and are required to check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- GMU's Social Media "best practices" guidelines: http://webdev.gmu.edu/Social_Media_Guidelines

Campus Resources

- The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See <http://caps.gmu.edu/>].
- The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing [See <http://writingcenter.gmu.edu/>]

Religious Holidays

A list of religious holidays is available on the University Life Calendar page (<http://ulife.gmu.edu/calendar/religious-holiday-calendar/>). Any student whose religious observance conflicts with a scheduled course activity must contact the Instructor at least 2 weeks in advance of the conflict date in order to make alternative arrangements

NOTE: *This information is subject to change with advance notification to the class.*