



*George Mason University*  
*SYST / HIST 202 – Fall 2021*  
*Engineering Systems in a Complex World*  
*Asynchronous Distance Learning*  
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### ***Course Syllabus and Schedule***

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

***Course Goals and Objectives:*** This course is cross-listed as both a systems engineering course and a history course. The reason is that it accomplishes two goals simultaneously: first, students examine complex engineering systems in global society, by looking at them through the lens of history; and second, students study global history through the social and technical development of complex systems. In this course, students will use historical case studies and critical analyses to think strategically and globally about the management and execution of technical systems in the context of politics, organization, economics, technology and society (POETS), and learn how to employ such historical analyses as engineering decision-making tools. Students will be required to critically analyze articles and books, and will work in groups to investigate and present topics of current national and international relevance. At the conclusion of this course, the student will have demonstrated:

- The ability to strategically analyze the mutual impact, interaction and interconnectedness between engineering complex systems and society, accounting for political, organizational, economic, technological and societal issues at a global scale;
- The ability to critically evaluate how different societies and cultures apply the tenets of systems engineering to their specific challenges and needs.

This course fulfills the following objectives:

- [ABET](#) criteria 3.4, “consider the impact of engineering solutions in global, economic, environmental, and societal contexts”.
- The [GMU Global Understanding portfolio](#), which requires students to “see the world from multiple perspectives, reflect upon their positions in a global society, and be prepared for future engagement as global citizens”.

***Prerequisites:*** None

***Course design:*** This course is taught in asynchronous distance-learning mode. Course weeks run from Monday through Sunday. Assignments are due at 11:59pm (ET) Sundays. There is only one scheduled live class meeting, Class 1. No scheduled live meetings after that, but one-on-one or group meetings can be scheduled as needed.

Each week has a different module with assignments and discussion boards. Assignments and discussion boards are self-paced, but you must complete all work by the end of the week, so you can move on to the next module (yes, you can complete your work early, but not late) . No tests, exams or quizzes (you’re welcome).

There are more individual homeworks early in the course, which reduce later in the course as you spend more time on your book review and team project (this averages out the workload).

**Course methodology:**

- Lectures – just a few in the early classes
- Reading – a LOT (~20 historical articles plus one book)
- Critical Thinking and Analysis – a LOT (every HW, every class).
- Writing – many short memos, blogs and essays; one 3-5 page book review
- Discussions – a LOT (every week has 1-5 discussion board topics). This is where the majority of the learning will take place, in interactions with your peers
- Narrated Presentations -- 1-2 narrated discussion board leads, several book review presentations, one team project presentation
- Student team project – 4-6 people researching and presenting on a relevant topic

**Grading**

|   |            |   |     |
|---|------------|---|-----|
| <u>Homework:</u>                          | <u>30%</u> | Book Review and Presentation:                               | 20% |
| <u>Class Participation:</u>               | <u>15%</u> | <u>(5% preview, 10% final report, 5% presentation)</u>      |     |
| <u>Lead Large-Group Class Discussion:</u> | <u>10%</u> | Capstone Team Project:                                      | 25% |
|   |            | <u>(5% proposal, 5% mid-review, 15% final presentation)</u> |     |

| <b>Letter Grade</b> | <b>Grade Point</b> | <b>Remark</b>  |
|---------------------|--------------------|----------------|
| 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        |

**Grading rubrics**

Assignments: homework, book reviews, team project

**Analysis of Facts -- 50%**

- Understands the basic facts and key issues in the assignment
- Makes relevant links between facts and analysis

**Critical Thinking -- 50%**

- Logically develops sequence of thought: facts, analyses and conclusions
- Supports conclusions with facts and analyses

Leading discussion board

- Clearly expresses main themes and ideas of the reading, both on slides and orally (50%)
- Engages classmates by inviting all points of view, compatible and competing (50%)

Class participation

- Engages with the group and respects others' views (50%)
- Develops original points and builds upon other's ideas during discussions (50%)

**Class participation:** Class participation is an important part of your grade. Discussion boards are where most of the learning will take place. How active you are in discussions will be taken into account for grading.

**Materials:** There is no course textbook and you are not required to buy any books for class. I will provide readings for class assignments on GMU’s Blackboard system. Students will use the GMU Library or other library resources for books to review, and for performing group research and presentations. You will need access to the GMU Blackboard system on a continual basis, and I will be communicating with you via GMU e-mail. Your devices (computer, laptop, tablet, etc.) need to be configured to the latest versions of these systems, so check with GMU’s Computing and Technology resource page for those requirements.

### **Course Schedule and Assignments**

| <b>Week</b> | <b>Module Topics</b>  | <b>Module HW to be completed</b>  | <b>Module Assignment</b>  |
|-------------|---|---|---|
| <b>1</b>    | <b>Course Introduction; Introduction to Systems Engineering</b>   | 1. Model answers (no submission)  | Lecture: Introduction and course objectives; What is systems engineering?                                   |
| <b>2</b>    | <b>Origins of Complex Systems Engineering:</b> The rise of modern systems engineering post-World War II and in the early Cold War   | 1. Johnson , “Three Approaches to Big Technology”<br>2. Sato, “Local Engineering and Systems Engineering”   | Readings: Presentations and discussion<br>Lecture: Origins of SE  |
| <b>3</b>    | <b>Military Systems and Society:</b> The shaping function of the military on systems engineering, and how it is applied to the larger society   | 1. Hughes, “SAGE”<br><br><b><u>Provide professor with book selection for individual book review</u></b>   | Readings: Presentations and discussion<br>Lecture: What do we mean by POETS?                                |
| <b>4</b>    | <b>Transportation as a Complex System:</b> The societal shaping of transportation systems technologies in the global context  | 1. Schrag, “Mapping Metro”<br>2. Ibsen, “Boeing vs. Airbus”   | Readings: Presentations and discussion<br>Discussion: Technology is neither good nor bad, nor is it neutral |
| <b>5</b>    | <b>Computers and Communications:</b> The societal shaping of information technologies in the global context   | 1. Light, “When Computers were Women”<br>2. Balbi, “Italian Broadcasting”<br><b><u>Form teams to select project topic</u></b><br><b><u>Submit book review preview</u></b> | Readings: Presentations and discussion<br><b>Book Reviews: Previews</b>                                     |
| <b>6</b>    | <b>Energy as a Complex System:</b> Global considerations of energy systems, including supply production, transport, infrastructure and users.   | 1. Nye, <i>Electrifying America</i><br>2. Hecht, “Politics and Reactors in France”<br><b><u>Provide professor with team project proposal</u></b>                          | Readings: Presentations and discussion<br><b>Team Project: Project Proposal Presentation</b>                |
| <b>7</b>    | <b>The Environment as a Complex System:</b> How differing global perspectives towards the environment are reflected in the analysis and response to climate and other environmental changes | 1. Edwards, “Climate Models”<br>2. Wesselink, “Dutch Response to Katrina”   | Readings: Presentations and discussion  |

| Week | Module Topics  | Module HW to be completed  | Module Assignment   |
|------|--|--|---|
| 8    | <b>The Organization as a Complex System:</b><br>How system complexity extends to the organizations that create those systems, and how both academic and business management have evolved to organize them. | 1. Chandler, "Railroads and Management"<br><br><u><i>Submit individual book review report</i></u><br><u><i>Submit individual book review presentation</i></u>                  | Readings: Presentations and discussion  |
| 9    | <b>The Household as a Complex System:</b><br>How advancements in domestic technologies change the relationships between occupants (e.g., roles of men and women), and with the technologies themselves.    | 1. Cowan, <i>More Work for Mother</i> Ch 3<br>2. Cowan, <i>More Work for Mother</i> Ch 4<br>3. Time magazine – Smart Home<br>4. Vox - Household Robots                         | Readings: Presentations and discussion  |
| 10   | <b>Health Care as a Complex Systems</b><br>How modern health care systems grew out of post-war policies  | 1. Scofea, "Development of Employer-Provided Health Insurance"<br>2. Toland, "How did America end up with this health care system?"<br><u><i>Submit Mid-Project Review</i></u> | Readings: Presentations and discussion<br><br><b>Team Project: Mid-Project Review</b> |
| 11   | <b>Safety of Complex Systems:</b><br>How differing cultural viewpoints influence social responses to anticipating and controlling the safety of complex technical systems.                                 | 1. Langewiesche, "ValuJet 592"<br>2. Hicks, "Normal Accidents in Military Operations"  | Readings: Presentations and discussion  |
| 12   | <b>Complexity and Decision-making under Uncertainty:</b><br>Ethical dilemmas of developing and managing complex systems when many outcomes (e.g., hazards, unintended consequences) are vague or unknown.  | 1. Hansson, "Safe Design"<br>2. <i>Challenger</i> Case Study<br>3. <i>Columbia</i> Case Study  | Readings: Presentations and discussion  |
| 13   | <b>Book Reviews</b>  | <b>Book review report and presentation</b>   | <b>Book Reviews: Presentations</b>  |
| 14   | <b>Final team project</b>  | <b>Team project presentation</b>   | <b>Team Project Presentations Engineering: Lone or social activity?</b>               |

See Course Schedule Calendar on the last page of this syllabus for dates of modules.

### **Homework**

Each reading selection will be accompanied by a list of reading questions in a separate Word document. *Most of the questions are framed as if you are an employee writing for your boss.* This is intentional – university is preparation for your career, and clear, concise writing is vital to your achievement. Therefore, answer the questions as if you were writing a memo at work. Provide SHORT BUT COMPLETE (2-3 paragraphs each) answers to each of these questions and submit them to before the class using Blackboard. Please view the following in the Assignments folder (Class 1): Perrow Normal Accidents.pdf and Perrow Model HW Answer.pdf. This will give you an idea of the way you should frame and develop your homework answers. 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 class number, in the following format: LASTNAME-CLASS 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](#)). I will review the document, add my comments and grade, and then post it back to you via Blackboard.

You should turn in your homework on time (i.e., the end of the module week, 11:59pm ET Sundays). If you cannot, please let me know the reason and we will work out a schedule. Otherwise, I will reduce your homework score by half a grade (for example, from an A to a B+) if it is up to three days late, a full grade (A to B) for up to six days late, and I will mark "incomplete" (equivalent to a 0) for a week or more late. I will allow resubmittals if the first submission is not acceptable (please make sure you take account of my critiques in your resubmission). *NOTE: If you fail to keep up with your homework assignments, you will be removed from your team. This will not only affect your grade but it will also impact the performance of your team.*

### ***Student-led case study: Discussion boards***

Each module has a list of discussion topics, generally relating to the homework question. Professor monitors but stays out of discussions, so student learning occurs without inhibitions.

Please read the discussion board instructions before starting.

I will need one person to lead each discussion. That person will create and post a narrated initial response to the discussion question, which is due on Wednesday. That give the rest of the students several days to carry on discussions until assignments due Sunday. Note: the discussion leader's initial post does not have to be exactly the same as the final written memo, as it is intended to begin the class discussion.

For discussion board leaders:

- Select top four choices to lead class discussion on discussion boards (see spreadsheet in Lead Class Discussion assignment folder) and email them to the professor by the end of Week 2
- I need three volunteers immediately for Module 2 discussions 1, 2 and 3; please send me an email right away).
- Check spreadsheet in Lead Class Discussion assignment folder for openings
- I may ask for people to lead more than one discussion. This should be based mostly on your interest, but as an incentive, leading additional discussions will be taken into account for the class participation part of the grading.
- After Week 2, I will make assignments for students to lead discussion boards, which may include leading more than one discussion.

Note: If you are assigned to lead a discussion and you have to miss this, you **MUST** tell me well ahead of time, in order that I can make adjustments. If you fail to do so, I may not be able to make adjustments and you may not receive credit.

***Independent Book Review:*** Students will read a book from the class reading list (see instructions and suggested list in the Book Review- Preview Assignments Folder in Module 5), then write a review of the book and present the main points to the class.

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 1<sup>st</sup> to 4<sup>th</sup> place. Please check spreadsheet in Book Review-Preview (Module 5) for books already assigned; don't choose them. I will make every attempt to assign you your top choice. You may instead choose another, relevant book outside the list, 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).

- You will submit a short (2-minute) narrated preview in Week 5. You will also post it to the relevant discussion board and comment on others.
- You will submit a 3-5 page (single-spaced) review by Week 13 (this does not get posted to discussion boards).
- You will submit a 10-15 minute narrated presentation of book review by Week 13. You will also post it to the relevant discussion board and comment on others

Templates are in the BB Assignments folder.

***Team Project:*** This integrates all of the course themes into a single, capstone project. Students will form into teams of 4-6 individuals. You should self-select into teams, otherwise I will assign you to a team. Your team will select (or be assigned) one of the topics under discussion in class, e.g., the environment as a complex system, or another relevant topic that I approve. *NOTE: If you fail to keep up with your homework assignments, you will be removed from your team. This will not only affect your grade but it will also impact the performance of your team.*

Each team will research a current systems engineering system, project or concept within that topic area, as related to culture, politics, organization and economics. You may choose the project or choose from one of the projects I suggest. Your team will use proper academic sources for your research (books, journal/newspaper articles, etc.).

- Teams form and select topics by Week 5 (or earlier)
- Teams submit 3-5 min narrated proposal in Week 6
- Teams submit 5-10 min narrated mid-project review in Week 10
- Teams submit narrated 20-30 min presentation in Week 14 (note that due date is the last day of class; please check the date as it may not fall on a Sunday)

### ***Administrative Notes:***

***Closings and cancellations:*** In the event of inclement weather or another major event, the university announces class cancellation, delay of classes and changes to administrative office hours through the university switchboard, 703-993-1000; the [George Mason home](#)

[page](#); GMU-TV; and local radio and television stations. If there is any doubt as to the status of the class, contact me. If I need to cancel a particular module, I will contact the students at the earliest possible opportunity.

*Emergency Preparedness:* In the event of an emergency, we will follow GMU procedures. You may want to register with [Mason Alert](#).

*Privacy:* Students must use their [MasonLIVE](#) email account to receive important University information, including messages related to this class.

*Academic Integrity (not just about cheating!):* GMU has an [Honor Code](#) with clear guidelines regarding academic integrity: “*Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work*”.

Three fundamental and rather simple principles to follow at all times are:

- (1) Do not plagiarize: all work submitted must be your own (in other words, never cut and paste whole phrases from a book or from the web);
- (2) Give credit when you use someone else’s words: when using the work or ideas of others, including fellow students, give full credit through accurate citations; and
- (3) Ask if you don’t know what to do: if you are uncertain about the ground rules on a particular assignment, ask me for clarification.

Plagiarism is generally thought of as a moral issue – it is dishonest to use someone else’s words as your own, without properly crediting the source. However: an equally important issue is that, when you copy someone else’s words, you are not learning. You are (or someone else is) investing valuable time and resources for you to attend university and learn stuff so you can have a bright future. If you copy and don’t learn, you are wasting your time and that person’s significant contribution to your future. Don’t do it.

*Accommodating students with specific needs:* If you have a documented learning disability or other condition that may affect your academic performance you should, **at the beginning of the semester:** 1) make sure this documentation is on file with the [Office for Disability Services](#) to determine the accommodations you need; and 2) speak with me to discuss your accommodation needs. Do not wait until the end of semester to do this!!!!

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

## Course Schedule Calendar – Fall 2021

| Dates (Mon-Sun) | Module Week Number | Topics   |
|-----------------|--------------------|--|
| Aug 23-29       | 1                  | Course Introduction; Introduction to Systems Engineering |
| Aug 30-Sept 5   | 2                  | Origins of Complex Systems Engineering                   |
| Sept 6-12       | 3                  | Military Systems and Society                             |
| Sept 13-19      | 4                  | Transportation as a Complex System                       |
| Sept 20-26      | 5                  | Computers and Communications                             |
| Sept 27-Oct 3   | 6                  | Energy as a Complex System                               |
| Oct 4-10        | 7                  | The Environment as a Complex System                      |
| Oct 11-17       | 8                  | The Organization as a Complex System                     |
| Oct 18-24       | 9                  | The Household as a Complex System                        |
| Oct 25-31       | 10                 | Health Care as a Complex System                          |
| Nov 1-7         | 11                 | Safety of Complex Systems                                |
| Nov 8-14        | 12                 | Complexity and Decision-making under Uncertainty         |
| Nov 15-21       | 13                 | Book Reviews   |
| Nov 22-28       |                    | <b>No Class -- Thanksgiving</b>                          |
| Nov 29-Dec 4    | 14                 | Final project  |