Narrative Summary of this Course:
This course exposes graduate students to the integration of systems and system of systems, with examples from computer products, information technology, and sophisticated products and services. Factors that affect the selection of various solutions in design will be examined, as well as optimizing the efficiency of integration issues. You will gain an understanding of the theory, context, and framework for planning and carrying out integration and development, including identifying and managing emergent behaviors. Techniques for partitioning of system-level functions and requirements to components will be discussed, as will practical guidance for integration and disintegration. Types of systems considered will be large-scale, spanning applications from purely technical to socio-technical. You will work on a substantial systems engineering integration/disintegration project to analyze, integrate, and describe a system or system of systems. Please contact the instructor or the systems engineering program director before registering to make sure that learning objectives meet your wishes.

Grading & Homework Assignments
You are afforded the latitude to explore ideas without the fear of “grading”. There is a time and place for grades. Consequently, the quizzes become a focal point of discussion both inside and outside classes. A typical quiz might involve a short video on a topic related to a homework assignment or an upcoming examination. It is a good learning environment for you to discuss the topic and your ideas with the class (the class includes the professor). Quizzes are not graded! Quizzes are based on comments you receive back from the instructor; discussions during office hours; and quips and quotes that are strikingly insightful.

The homework assignments are geared to provide a “limited” time span to think about the concepts presented in the classroom materials. Reminder: there are only 24 hours in a day. Plan wisely. In many instances, the homework is the first time you will be exposed to certain concepts. How do you plan for the unknown? Draft your ideas quickly. Let these formative thoughts soak for a day in your life. Turn your ideas into a draft. Sit on it for 16 hours (hindsight
is always 20/20 😊. Polish the draft and submit for comments. Homework is provided with feedback as a benchmark of your progress through the material. Instructor’s comments are formative as they will be used as topical guidelines for subsequent homework as well as other assignments and quizzes.

**All work in this course is individual work.** However, that is not to say that you should ignore the work and thinking of your classmates (again, remembering to think of your professor as a student in the class). Copy and use freely anything that can help you, remembering to always cite the work of others. For example, if when you read something or hear something that you want to use or adapt to your use, you must cite the source, e.g., by stating “inspired by… (source and date)” All works of authorship are copyrighted the moment you or someone else writes them down, thereby objectifying those thoughts. Borrow a thought, give deserved credit to the source.

**The Major Assignment.** For your SYSE 595 Project, you are expected to complete a beginning-to-end analysis of the plan for integrating a system or system of systems, OR a beginning-to-end analysis of the plan for disintegrating a system or system of systems. You MUST review either of these two topics in terms of both a system and a system of systems. State why either the model of system or system of systems is best for your integration/disintegration. Starting with a problem, then design (with functional analysis), comprehensive architecture, stakeholders and their needs, principles, requirements (and their mappings to processes, functions, physical aspects), measures of performance, schedule for development or destruction, implementation risks, lifecycle planning issues, and means to test, verify, and validate the solutions, and include the managing of process of integration or disintegration. The work requires a systems approach that identifies the functional relations between parts and the whole (all of which you must describe). Performing the integration/disintegration planning is a primary focus for your project work. As such, scenarios must be developed to perform appropriate tradeoffs to help determine the best plan.

You can expect that individualized feedback and your response will be time-consuming. The result is a personalized learning opportunity that is customized to your project, as a means of supplementing your knowledge with specific items that you need to extract a great amount of information from the course. In this regard, the instructor is your personal tutor with the agreed goal of assuring that you understand and can demonstrate all of the learning objectives.

Students seem to very much enjoy this approach of instruction and go on to apply the lessons learned in their professional careers. Please take advantage of this opportunity to engage in discussions with the professor and your classmates.

**Homework Assignments:**

For students new to Portland State, you have two assignments in the first week of the quarter:

Z-1 Please write about yourself; your background and interests; and why you want to study systems engineering for. Please send to email: lgary@pdx.edu.

Place the following in the subject line of your email and use the same format for the name of each assignment, quiz, test, email, and email attachment:

Last Name, First Name, Assignment Number; e.g., Course (SYSE 595), Summer 2018

**EXAMPLE:** Langford, Gary, Z1, SYSE 595 Summer 2018
Z-2    Show how you convert $1.142 \times 10^{-5}$ years into minutes, the time you might expect to complete this homework, and yes the total time includes the time it takes you to determine number of minutes available for this task. (Time yourself to an accuracy of 15 sec. or $4.7565 \times 10^{-7}$ years). Please email your homework to lgary@pdx.edu, applying the same format for naming each assignment and subject in your email and ALL attachments. Thank You.

Beginning in the second week of the quarter, all students are assigned the same assignments:
Y-1    What is a principle? What are several principles of or related to systems or systems of systems integration?
Y-2    What is a problem? Describe and discuss a Problem related to integration or disintegration of a system or system of systems. Assignment Y-2 is intended to be the start of the primary project report for this course, due this quarter.
Y-3    Describe the system or system of systems highlighted in Y-2. What are the needs necessary to solve the Problem you identified in Y-2?
Y-4    What should be considered and what are the procedures to determine the plan to integrate or disintegrate the system or system of systems highlighted in Y-3?
Y-5    What is the plan to integrate or disintegrate the system or system of systems highlighted in Y-3?
Y-6    What are the expected results of your plan (Y-5) and what are the risks and commensurate risk mitigation?
Y-7    What would you now add to Y (1-6) as your final thoughts?
Y-8    Combine all Y assignments and submit as Final Integration/Disintegration Project Plan
Y-9    Systems Engineering Journal to record your thoughts, ideas, questions, and reflections on systems approach, systems engineering, and systems integration.
Y-10   e-Portfolio inputs

Points:
Homework
Z1 [10 points]
Z2 [10 points]
Y1 [10 points]
Y2 [10 points]
Y3 [10 points]
Y4 [10 points]
Y5 [10 points]
Y6 [10 points]
Y7 [10 points]
Textbook and Reading Assignments

Engineering Systems Integration: Theory, Metrics, and Methods, Gary O. Langford; May 2012; CRC Press, Taylor and Francis Group. ISBN 9781138074125 (available from PSU bookstore or online)

Assignment Due Dates:

<table>
<thead>
<tr>
<th>Week #</th>
<th>Assignments</th>
<th>Page #s</th>
<th>Given</th>
<th>Due</th>
<th>Name</th>
</tr>
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<tbody>
<tr>
<td>Week 1</td>
<td>Chpt. 1</td>
<td>1- 28</td>
<td>25 Sep</td>
<td>4 Oct</td>
<td>Z1, Z2</td>
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<tr>
<td>Week 2</td>
<td>Chpt. 2</td>
<td>29-102</td>
<td>2 Oct</td>
<td>12 Oct</td>
<td>Y-1</td>
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<tr>
<td>Week 3</td>
<td>Chpt. 3 and Preface</td>
<td>103-188</td>
<td>9 Oct</td>
<td>18 Oct</td>
<td>Y-2</td>
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<tr>
<td>Week 4</td>
<td>Chpt. 4</td>
<td>189-213</td>
<td>16 Oct</td>
<td>25 Oct</td>
<td>Y-3</td>
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<tr>
<td>Week 5</td>
<td>Chpt. 5 and Midterm Exam</td>
<td>215-282</td>
<td>23 Oct</td>
<td>1 Nov</td>
<td>Y-4</td>
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<tr>
<td>Week 6</td>
<td>Chpt. 6 and Appendix A</td>
<td>283-334</td>
<td>30 Oct</td>
<td>8 Nov</td>
<td>Y-5</td>
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<tr>
<td>Week 7</td>
<td>Review Glossary of Terms</td>
<td>353-374</td>
<td>6 Nov</td>
<td>15 Nov</td>
<td>Y-6</td>
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<td>Week 8</td>
<td>Submit Final Integration/Disintegration Project Plan</td>
<td></td>
<td>22 Nov</td>
<td></td>
<td>Y-7</td>
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<td>Week 9</td>
<td>Final Examination</td>
<td></td>
<td>27 Nov</td>
<td>4 Nov</td>
<td>Y-8, Y-9</td>
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WEEKLY READING ASSIGNMENTS THROUGHOUT THE COURSE

- Knowledge Objective – learn the language constructs of systems engineering theory, approach, and method
- Doing Objective – you are to portray concepts descriptively and graphically— showing relations between terminology, uses, and actions
- Value Objective – Develop a graphical model for systems engineering concepts that emphasizes clarity with a small amount of information – to build your mental model. Learn to include your perspective about what others think and what others say by reading a few other sources that discuss systems engineering.


Week 1: READING ASSIGNMENTS

Read Langford – pages III through XIV; and Read Ahead). Note there is a glossary of defined terms near end of the book.
Blanchard/Fabrycky – no assignment.
Recommend you select a text or papers from the References on our D2L website to read and reflect on your thoughts in your writings.

**Week 2: READING ASSIGNMENTS**
Read Langford – pages 1 through 28 (Chapter 1)
Read Blanchard/Fabrycky – Chapter 1
Recommend you select a text or papers from the References on our website to read and reflect on your thoughts in your writings.

**Week 3: READING ASSIGNMENTS**
Read Langford – pages 29 through 56 (the first third of Chapter 2)
Read Blanchard/Fabrycky – Chapter 2
Recommend you select a text or papers from the References on our website to read and reflect on your thoughts in your writings.

**Week 4: READING ASSIGNMENTS**
Read Langford – pages 57 through 74 (the second third of Chapter 2)
Read Blanchard/Fabrycky – Chapter 3, sections 3.1-3.7
Recommend you select a text or papers from the References on our website to read and reflect on your thoughts in your writings.

**Week 5: READING ASSIGNMENTS**
Read Langford – pages 75 through 102 (the third third of Chapter 2)
Read Blanchard/Fabrycky – Chapter 4
Recommend you select a text or papers from the References on our website to read and reflect on your thoughts in your writings.

**Week 6: READING ASSIGNMENTS**
Read Langford – pages 103 through 129 (the first third of Chapter 3)
Read Blanchard/Fabrycky – Chapter 5
Recommend you select a text or papers from the References on our website to read and reflect on your thoughts in your writings.

**Week 7: READING ASSIGNMENTS**
Read Langford – pages 130 through 153 (the second third of Chapter 3)
Read Blanchard/Fabrycky – Chapter 6
Recommend you select a text or papers from the References on our website to read and reflect on your thoughts in your writings.

**Week 8: READING ASSIGNMENTS**
Read Langford – pages 153 through 188 (the third third of Chapter 3)
Read Blanchard/Fabrycky – Chapter 7
Recommend you select a text or papers from the References on our website to read and reflect on your thoughts in your writings.

**Week 9: READING ASSIGNMENTS**
Langford Engineering Systems Integration – no assignment
Read Blanchard/Fabrycky – Chapter 14
Recommend you select a text or papers from the References on our website to read and reflect on your thoughts in your writings.

Week 10: READING ASSIGNMENTS
No further reading assignments in either textbook.

Grading Scale

It is my intention to work with you to build your knowledge in Systems Engineering Integration so you have a superior understanding and proficiency. To that end, I will assist you with whatever you need to do to learn the materials. I commit my efforts to your success. Please take advantage of my offer.

Grading Scale & Percentage of allocated points that are normalized to 100 points

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>93+</td>
</tr>
<tr>
<td>A-</td>
<td>90-92</td>
</tr>
<tr>
<td>B+</td>
<td>88-89</td>
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<tr>
<td>B</td>
<td>82-87</td>
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<tr>
<td>B-</td>
<td>80-81</td>
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<tr>
<td>C+</td>
<td>78-79</td>
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<tr>
<td>C</td>
<td>72-77</td>
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<tr>
<td>C-</td>
<td>70-71</td>
</tr>
<tr>
<td>D</td>
<td>60-69</td>
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<td>F</td>
<td>&lt;60</td>
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<table>
<thead>
<tr>
<th>Grade</th>
<th>GPA</th>
<th>Meaning</th>
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</thead>
<tbody>
<tr>
<td>A+</td>
<td>4.3</td>
<td>Exemplary achievements. Student performance demonstrates professional level command of the course materials and leads in innovating with broad use of Systems Engineering precepts and specifics</td>
</tr>
<tr>
<td>A</td>
<td>4.0</td>
<td>Outstanding achievement. Student performance demonstrates full control of the course materials and evinces a high level of originality and/or creativity that far surpasses course expectations</td>
</tr>
<tr>
<td>A-</td>
<td>3.75</td>
<td>Excellent achievement. Student performance demonstrates thorough knowledge of the course materials and exceeds course expectations by completing all requirements in a superior manner</td>
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<tr>
<td>Grade</td>
<td>Points</td>
<td>Description</td>
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<tr>
<td>-------</td>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>B+</td>
<td>3.5</td>
<td>Very good work. Student performance demonstrates above-average comprehension of the course materials and exceeds course expectations on all tasks as defined in the course syllabus</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
<td>Good work. Student performance meets designated course expectations, demonstrates understanding of the course materials and is at an acceptable level</td>
</tr>
<tr>
<td>B-</td>
<td>2.75</td>
<td>Marginal work. Student performance demonstrates incomplete understanding of course materials.</td>
</tr>
<tr>
<td>C+</td>
<td>2.75</td>
<td>Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course materials</td>
</tr>
<tr>
<td>C</td>
<td>2.0</td>
<td></td>
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<tr>
<td>C-</td>
<td>1.75</td>
<td>Unacceptable work.</td>
</tr>
<tr>
<td>D+</td>
<td>1.35</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>D-</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>0.0</td>
<td>Failing.</td>
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</table>

**Reach Back Policy:**

Systems Engineering at Portland State University can better serve its students (users/customers) and student sponsors (customers) through continued communication between graduates and faculty. The intent is to continue dialog after graduation, specifically to encourage:
- Students to maintain contact with professors
- Faculty to remain in contact with graduates
- Faculty to assist students in post-graduate activities
- Faculty to maintain currency with the DoD customer(s) and needs
- Students to keep up with the latest advances in systems engineering and the bleeding-edge of excitement.

With Kindest Regards,
Gary Langford