Course title and number: Systems Thinking, ISEN 440
Term: TBD
Meeting times and location: TBD
Hours: 3 credits

Course Description and Prerequisites

Introduction to the systems thinking process, systems of systems, and the fundamental considerations associated with the engineering of large-scale systems, or systems engineering. These include systems modeling and design, the system development process (needs analysis, concept exploration, concept definition, engineering design, integration and evaluation) and systems engineering management.

Prerequisites
MATH 304 or approval of instructor.

Semester Team Project
Students will form semester teams comprising 3-5 students and each team will work on an interesting real-life problem of their choice, and apply the systems engineering approach to model, analyze and design a system model to address the problem. Each team will learn to use IBM Systems Developer software (or equivalent software) to develop the systems engineering documents for the project, write a project report, and give a presentation of their results at the end of the semester.

Learning Outcomes or Course Objectives
Students should be able to 1) understand the anatomy of engineered systems and their complex interactions; 2) formulate, analyze, and interpret issues associated with engineered systems; use systems thinking techniques and software tools necessary for systems engineering practice; and 3) model and analyze engineered systems using systems engineering tools.

Instructor Information
Name: Lewis Ntaimo, Ph.D.
Telephone number: 979-458-2360
Email address: ntaimo@tamu.edu
Office hours: TBD, open-door policy
Office location: ETB 4008

Textbook and/or Resource Material
References:

Grading Policies

The grade for the course will be based homework and in-class quizzes, exams, semester project, and on the level and quality of your participation during class. No late assignments will be accepted. There will be three exams based on the material covered in class, homework and reading assignments. The three exams will constitute 60% of the grade while the other 40% will come from the homework and in-class assignments (20%) and team project (20%). Grades will be assigned as follows:

A (90-100%), B (80-89.9%), C (70-79.9%), D (60 – 69.9%), F (< 60%).

Course Topics, Calendar of Activities, Major Assignment Dates

Tentative important dates:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Module 1: Course Overview</td>
<td>Kossiakoff, Ch. 1, 2; Buede, Ch. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 1-2</td>
<td>Module 1: Introduction to Systems Engineering</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td>Module 2: Structure of Complex Systems</td>
<td>Kossiakoff, Ch. 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 4-5</td>
<td>Module 3: Systems Thinking Concepts and Tools</td>
<td>Hitchins, Ch. 1,8,9, Gharajedaghi, Ch. 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 5</td>
<td>Module 4: Set Theory</td>
<td>Lecture slides, Buede, Ch. 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 6-7</td>
<td>Module 5: Systems Modeling</td>
<td>Buede, Ch. 4; Wymore, Ch. 2, Zeigler, et al., ch. 1, 2,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 8-9</td>
<td>Module 6: Theory of Systems Design</td>
<td>Buede, Ch. 6; Wymore, Ch. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 9-10</td>
<td>Module 7: Systems engineering tools, UMI Rational systems developer software, SysML, IDEF</td>
<td>Lecture slides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 10-13</td>
<td>Module 8: The system development process</td>
<td>Lecture slides, Kossiakoff, Ch. 4-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 14</td>
<td>Final review, students finalize their project reports</td>
<td>Lecture slides</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Other Pertinent Course Information

Detailed Course Structure

Module 1 – Introduction
SE definitions, origins, complex systems, SE viewpoint, profession, power
Refs: Kossiakoff, Ch. 1-2

Module 2 – Structure of Complex System
Systems development process
SE technical knowledge
Hierarchy of complex systems
System building blocks,
System environment, interfaces & interactions
Refs: Kossiakoff, Ch. 3-4

Module 3 – Systems Thinking
Basic models and constructs
Systems thinking principles
Classification
CLMs
N² Charts
Refs: Hitchins, Ch. 1, 8, 9; Gharajedaghi, Ch. 2

Module 4 – Set Theory
Sets
Partitions and power sets
Cartesian products of sets
Relations
Functions
Refs: Course notes; Buede, Ch. 4

Module 5 – Systems Modeling
Dynamical systems concept
Discrete time system models
Theoretical properties of systems models
System coupling
Refs: Course notes; Wymore, Ch. 1

Module 6 – Systems Design Theory
Theory of system design: FSD, BSD, ISD, system testing
Writing system requirements
Refs: Course notes; Buede, 6; Wymore, Ch. 1

Module 7 – SE Tools
Overview of SE tools
Unified Modeling Language (UML)
IBM Rational Systems Developer Software
Refs: Course notes

Module 8 – SE Process
System engineering management plan
The system development process
Advanced development
Real life case study: Project 28
Refs: Kossiakoff, Ch. 5-10
Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu

Academic Integrity

For additional information please visit: http://aggiehonor.tamu.edu

“An Aggie does not lie, cheat, or steal, or tolerate those who do.”