Systems Design and Engineering
A Product Perspective
MIE1514H

Instructor: Professor Nashed Youssef
Email: nashed.youssef@utoronto.ca

Course Topics:
System level thinking in products development
What is a system and what is systems engineering?
What is system reliability?
System engineering process
The role of the system engineer
Morphology of system level design
System level design requirements
System architecture, concept generation
Modeling and simulation
Verification vs. validation
System optimisation
Multi disciplinary optimisation
System competitive analysis and reverse engineering
Risk assessment and technical readiness level
Margins and contingency
Customer delight
System reliability

Prerequisite: Bachelor of Engineering.

Purpose of the Course: The course objective is to familiarize students with the principles and methods of systems engineering. It includes specific integrated examples and projects to aid in understanding and appreciating fundamental principles. Students will apply the various systems engineering methods and techniques as appropriate across all phases of a product's life cycle. The course will prepare students who are or will be involved in high technology complex systems, and the preliminary and detailed design of products.

The course will be delivered using a mixture of formal presentations, informal discussions, and applications of key aspects of systems engineering. A term project to create and develop a product will allow students to put theory into practice.

Grading Scheme: Weekly attendance: 20%, timely assignments submission: 30%, term project final report: 25%, project oral presentation: 25%.

Term project: The student selects a product or a system of choice. The students may team with one or two other students for one project. The project involves the

understanding of the product design, applying system engineering. The student develops customer requirements, develop alternatives and compare them to the existing design, develop some criteria that may help select one alternative as most likely to succeed and describe how it will improve on the existing design, discuss what the limitations are, and why it is a better than the existing design.

The marking scheme for the written reports is as follows: Clarity 20%, technical content 40%, quality 20% and discussion/ conclusion 20%

Project Abstract Submission: An abstract of proposed project topic will be submitted in the third week of the course.

Oral presentations: An oral presentation based on the project will be presented to the class. The presentations should demonstrate an increase in the breadth of knowledge obtained from the course and expose additional related topics.

The date and time for the presentation will be agreed upon on the 9th week of the course. Presentations will be 15 minutes in length given during the last three lecture periods.

The marking scheme for the oral presentations is as follows: Clarity 20%, technical content 40%, quality and delivery 20% and ability to manage discussions 20%.

Resources:
Boeing Systems Architecture Development Guidebook
"The Art of Systems Architecting", Eberhardt Rechtin, Mark W. Maier
DoD Architecture Framework (DoDAF)
Systems Engineering Guidebook 1997 – James N. Martin
INCOSE Systems Engineering Handbook (INCOSE-TP-2003-016-02,
        version 2a, 1 June 2004)
DOD Systems Engineering Fundamentals January 2001
NASA Systems Engineering Handbook June 1995
Systems Engineering Standards
MIL-STD-499B Military Standard
EIA/IS 632 (1994) and EIA 632 (1998) Standards
ISO/IEC 15228 Standard
IEEE Std 1220 (2005 version)
EIA 731.1 Systems Engineering Capability Model
Journal Papers and Articles about Systems Engineering
Reliability engineering principles for the plant engineer, Troyer, Noria Corporation.