



Prince Mohammad Bin Fahd University

Core Curriculum Program

Introduction to Systems Thinking (SYST 1311) Syllabus

Semester Credit Hours: 3 (3, 0)

I. Course Overview

Students are introduced to systems theory to see the world in terms of interconnected patterns that constitute human, technical and natural systems, and to learn how to reinforce or change these systems appropriately. Students focus on a technology-focused organization to document their interconnected systems such as goals, strategy, environments, structures, processes and people.

II. PMU Competencies and Learning Outcomes

It is imperative that students be aware of legal issues affecting business. Students become acquainted with major business law concepts which will make them more efficient and effective managers of the legal issues affecting their organizations.

- Critical thinking and problem solving are developed as students analyze assigned questions, exercises, problems and cases.
- Oral, written and listening skills are developed as students are encouraged to participate in class, to do written homework assignments and to interact with other classmates.
- Teamwork is promoted as students are encouraged to work as part of a group in their case analysis.
- Modern information technology is utilized through the Internet as a learning resource and spreadsheets as tools in classroom preparation and homework assignments.

III. Detailed Course Description

Systems' thinking is a discipline of seeing the "whole", recognizing patterns and interrelationships, and learning how to innovate a more effective, efficient and creative system solution(s). This course will acquaint students to basic concepts of systems thinking. The primary emphasis will be the introduction of basic systems thinking fundamentals, i.e. defining a systems perspective about any situation or problem, solving problems with that perspective, describing and modeling a problem, and designing and improving upon system solutions.

IV. Requirements Fulfilled

The course is an elective for students who are, at the minimum, in the second semester of freshman year of undergraduate study.

V. Preferred Co-requisites

UNIV 1212 Critical Thinking & Problem Solving

UNIV 1213 Leadership and Teamwork

IV. Learning Outcomes

After completing this course student will be able to:

- Provide an overview of the history, research and perspectives into systems thinking
- Understand and document system thinking objectives
- Establish a basic understanding of systems thinking terminology, theories, processes, methods, language and tools.
- Evaluate when it is appropriate to apply thinking methods, i.e. reductionist methods (ex. data collection, scientific method, etc.) as opposed to applying systems thinking methods (ex. ,Systems Engineering, Breakthrough Thinking/Smart Questions, etc.)
- Describe and model solutions that will enable system thinking ex. (mind maps, feedback & causal loops, behavior over time diagrams, etc.)
- Apply systems engineering and analysis techniques to various problems. (socio - technical, supply chain, value chain / lean, etc.)

V. Assessment Strategy

Case studies/assignments	10%
Mid Term examination	20%
Final Examination	30%
Group based case study	40%

PMU Grading Scale		
Letter Grade	Range	GPA
A+	96 – 100	4.00
A	90 – 95	3.75
B+	86 – 89	3.50
B	80 – 85	3.00
C+	76 – 79	2.50
C	70 – 75	2.00
D+	66 – 69	1.50
D	60 – 65	1.00
F	0 - 59	0.00

VI. Course Format

A variety of teaching approaches are used including lectures, class discussion, cases, exercises, group project, videos, and guest speakers from local businesses or government. Students are expected to come prepared for classes and be ready to discuss the topics assigned. The instructor addresses questions on aspects that the students

could not comprehend by reading on their own. Students are encouraged to take active part in their learning.

Classroom Hours (3 hours per week)

Class: 3

Lab: 0

VII. Topics to Be Covered

Introduction: Definitions & Concepts

- a. The Purpose
- b. What is Thinking?
- c. What is a System?
- d. What is Systems Thinking?
- e. Why Systems Thinking?
- f. System Principles & Concepts (Reductionist vs Holistic)
- g. Key Terminology

View from the Past to Present

- h. General Systems Theory
- i. System Science
- j. Systems Approaches
- k. Cybernetics
- l. Exercise

Dealing with Complexity

- m. Hierarchy
- n. Evolution
- o. Description
- p. Emergence
- q. Adaptive Complex Systems
- r. Exercise

Process & Methods I

- a. Hard, Soft, Evolutionary, and Complex Adaptive Systems
- b. Methods (Hard: Systems Analysis, Systems Engineering, Operations Research; Soft: Soft Systems Methodology, Rigorous Soft Method, Breakthrough Thinking)
- c. Exercise

Process & Methods II

- a. Systems Engineering & System Architecting
- b. System Concept & Design

Systems Implementation and Applications

- a. Systems Architecting and Evolutionary Development
 - i. Spiral vs incremental implementation
 - ii. Timely system implementation
 - iii. Incremental Commitment Model
- b. Planning system design and technical implementation
 - i. Prioritize system capability phasing
 - ii. Technology Road-mapping

c. Managing systems

Research Needs Regarding Future Systems Thinking and Next Steps

VIII. Laboratory Exercises

This course does not require a separate lab.

IX. Technology Component

Students are expected to have a computer account on the University's Blackboard system to communicate via e-mail and should sign up for the online discussion group or the class. They are also expected to be familiar with the online supplementary material available. Collaborative learning problems and cases require the student to use word processing, spreadsheets and other information/computer technologies.

X. Textbooks and Teaching Aids

A. Required Textbook(s)

Anderson, V., & Johnson, L. (1997). *Systems thinking basics* (pp. 1-14). Cambridge, MA: Pegasus Communications.

B. Alternative Textbook

Hitchins, D. K. (2003). *Advanced systems thinking, engineering, and management*. Artech House.

C. Supplemental Materials

1. Bela H. Banathy (1996) *Designing Social Systems in a Changing World* NY: Plenum
2. Ludwig von Bertalanffy (1968) *General System theory: Foundations, Development, Applications*, George Braziller New York
3. Peter Checkland (1981) *Systems Thinking, Systems Practice*. (Wiley)
4. Peter Checkland Jim Scholes (1990) *Soft Systems Methodology in Action*. (Wiley) ISBN 0-471-92768-6
5. Peter Checkland Jim Sue Holwell (1998) *Information, Systems and Information Systems*. (Wiley) ISBN 0-471-95820-4
6. John Gall (1978) *Systemantics* Pocket Books
7. Jamshid Gharajedaghi (2005) *Systems Thinking, Second Edition: Managing Chaos and Complexity: A Platform for Designing Business Architecture* (Butterworth-Heinemann)
8. Charles L. Hutchins (1996) *Systemic Thinking: Solving Complex Problems* CO:PDS ISBN 1-888017-51-1
9. Daniel H. Kim (1995) "Systems Thinking Tools: A User's Reference Guide" Part of the Toolbox Reprint Series. (Pegasus Communications Inc.)
10. Joseph O'Connor, Ian McDermott (1997) *The Art of Systems Thinking: Revolutionary Techniques to Transform Your Business and Your Life* HarperCollins.
11. Peter M. Senge (1990) *The Fifth Discipline - The Art & Practice of The Learning Organization* (Currency Doubleday).

12. Sherwood, D., Seeing the Forest for the Trees: A Manager's Guide to Applying Systems Thinking, Nicholas Brealey Publishing, London, 2002
13. Lars Skyttner (2006) *General Systems Theory: Problems, Perspective, Practice* (World Scientific Publishing Company) ISBN 9-812-56467-5
14. Gerald M. Weinberg (1975) *An Introduction to General Systems Thinking* (1975 ed., Wiley-Interscience) (2001 ed. Dorset House).
15. Brian Wilson (Systems) (1984) *Systems: Concepts, Methodologies and Applications*. (Wiley) ISBN 0-471-92716-3
16. Brian Wilson (Systems) (2001) *Soft Systems Methodology: Conceptual Model Building and its Contribution*. (Wiley) ISBN 0-471-89489-3
17. Heidi Leoti Davidz, *Enabling Systems Thinking To Accelerate The Development Of Senior Systems Engineers*, Doctor Of Philosophy In Engineering Systemsat The Massachusetts Institute Of Technology, February 2006
18. Midgley, G., *Systems Thinking, Volume IV, Critical Systems Thinking and Systemic Perspectives on Ethics, Power and Pluralism*, Sage Publications, 2003