



# Stevens Institute of Technology

## Syllabus

### **SYS 605 Spring 2011: Systems Integration**

**Cross-listed as:** SDOE 605

**Course Co-requisite:** SYS/SDOE 625 Fundamentals of Systems Engineering

### **Overview**

Systems Integration introduces students to the principles and processes of early validation, integration, test, verification, transition, and validation within the systems engineering discipline. The course enables students to more effectively integrate and prove-in solutions that meet system requirements and customer needs. The course centers on a group project that students pursue in small teams of 3 to 4. Systems Integration provides students with disciplined approaches for 1) performing early validation of a solution to meet a customer or stakeholder need, 2) factoring integration and test issues into the system requirements and architecture, 3) identifying and selecting among alternative means to integrate and test, 4) identifying comprehensive test cases, 5) performing fault diagnosis, 6) verifying systems, 7) transitioning systems, and 8) validating systems. The focus is on extending the model-based approaches that are introduced in the courses on Fundamentals of Systems Engineering and Systems Architecture and Design for integration, verification, transition, and validation. The course also emphasizes the importance of systems engineering the integration and test environment used to build and prove-in the system being developed. The intent is not just to describe the systems integration, testing, verification and validation process. Rather, the course helps students understand how to think through the choices at each step of the process. What decisions have to be made? What factors should be considered in making them? It is the answers to these questions that make for good systems integration, not just adherence to a standard process. The primary objective of this course is for the student to leave with a strong foundation in systems integration principles and processes.

### **Learning Goals**

After taking this course, the student will be able to:

- Understand the up-front need to factor in the integration, test, verification and validation of a system in determining the system requirements and architecture.
- Review and evaluate the various system integration, test, verification, and validation models in use today.
- Plan the integration, verification and validation of the system of interest being developed.
- Understand the criticality of defining, documenting and managing interfaces during system development.
- System engineer and architect the integration and test environment.
- Select suitable test methods, techniques, and metrics.
- Apply fault diagnosis techniques.
- Adopt a systems perspective when making integration and test decisions that affect the determination of performance, development time, or total ownership cost of the system.

### **Expectations for Students**

Students are expected to 1) complete reading assignments, including course notes and supplementary papers, before each class; 2) complete homework assignments and submit them on or before their due dates, 3) be engaged in class; 4) be respectful of others in the course; and 5) abide by the Steven's Honor System.

## Pedagogy

The course employs lectures, supplemental reading, software tools, weekly discussions, team assignments, team preparation of plans, and an individual final examination.

## Required Text(s)

Jan Tretmans, editor, **Tangram: Model-based integration and testing of complex high-tech systems**, Embedded Systems Institute, free download at <http://www.esi.nl/publications/tangramBook.pdf>

## Supplemental Readings

Supplemental Readings are assigned for class discussion.

## Software

A systems engineering tool: CORE will be provided for the class, and used. The University edition of CORE is provided at no charge to the students of this course and can be downloaded from Vitech Corporation <http://www.vitechcorp.com>.

Design Structure Matrix (DSM) tools are available at <http://www.dsmweb.org/>, specifically Excel macro add-in from MIT is freely provided at <http://129.187.108.94/dsmweb/en/dsm-tools/research-tools/excel-macros-for-partitioning.html>.

## Course Outline

The course is divided into modules that are completed over one or more weeks. Students are usually required to complete one individual or team assignment each week for review at a subsequent class. There is also a project team report and individual final exam due at the end of the semester.

## Student Performance Assessment and Assignments

The specific details of assignments are posted online.

GRADED EVENTS	Points
Student Profile	10
Mid-Term and End-of-Semester Self/Team Assessments	5 5
9 Project Team Assignments	180 (20 each)
12 Weekly Discussions	180 (15 each)
Integration Plan (Team Effort)	80
Verification Plan (Team Effort)	160
Validation Plan (Team Effort)	80
Individual Take Home Final Exam	300
<b>TOTAL</b>	<b>1000</b>

Please note that assignments and papers in this class may be submitted to [www.turnitin.com](http://www.turnitin.com), a web-based anti-plagiarism system, for an evaluation of their originality. Projects and homework are scheduled for submission on the dates shown on the course Calendar.

Prior approval must be received for late assignments.

## Grading and Criteria for Passing

- (1) Turn in all written material (see weekly assignments on the assignment schedule).  
(2) Final grades will be awarded in accordance with the following scale:

Grade	Percentage
A	90 - 100
B	80 - 89
C	70 - 79
F	<70

## Course Schedule

Week #	Topic	Dates
0	Course Syllabus Student Profile ESI Tangram Book Download Tsunami Warning System Case Study CORE Software Tool Download	1/24/2011 to 1/30/2011
1	Systems Engineering Overview	1/31/2011 to 2/6/2011
2	Requirements Validation	2/7/2011 to 2/13/2011
3	System Interfaces	2/14/2011 to 2/20/2011
4	System Architecture Validation	2/21/2011 to 2/27/2011
5	System Integration	2/28/2011 to 3/6/2011
6	Black Box Test Cases	3/7/2011 to 3/13/2011
7	White Box Test Cases	3/14/2011 to 3/20/2011
8	System Verification	3/21/2011 to 3/27/2011
9	System Transition	3/28/2011 to 4/3/2011
10	System Validation	4/4/2011 to 4/10/2011
11	Integration and Test Architecture	4/11/2011 to 4/17/2011
12	Fault Diagnosis	4/18/2011 to 4/24/2011
13	Wrap-Up and Individual Take-Home Final Exam	4/25/2011 to 5/1/2011
	<b>Last Day of Semester</b>	<b>5/6/2011</b>

## Class Assignment Schedule

Week #	Assignment	Assignment Due Date
0	Student Profile (10 pts) Download ESI Tangram Book Download Tsunami Warning Case Study Download and Install CORE	1/30/2011
1	Week 1 Discussion Questions (15 pts) CORE Familiarization (ungraded) <b>All students on a project team</b>	2/6/2011
2	Requirements Validation Team Assignment (20 pts) Week 2 Discussion Questions (15 pts)	2/13/2011
3	System Interfaces Team Assignment (20 pts) Week 3 Discussion Questions (15 pts)	2/20/2011
4	System Architecture Validation Team Assignment (20 pts) Week 4 Discussion Questions (15 pts)	2/27/2011
5	System Integration Team Assignment (20 pts) Week 5 Discussion Questions (15 pts)	3/6/2011
6	Week 6 Discussion Questions (15 pts) Mid-Term Self/Team Assessment Report (5 pts) <b>System Integration Plan (Team Report) (80 pts)</b>	<b>3/13/2011</b>
7	Black Box and White Box Test Case Team Assignment (20 pts) Week 7 Discussion Questions (15 pts)	3/20/2011
8	System Verification Team Assignment (20 pts) Week 8 Discussion Questions (15 pts)	3/27/2011
9	Week 9 Discussion Questions (15 pts) <b>System Verification Plan (Team Report) (160 pts)</b>	<b>4/3/2011</b>
10	System Validation Team Assignment (20 pts) Week 10 Discussion Questions (15 pts)	4/10/2011
11	Integration and Test Architecture Team Assignment (20 pts) Week 11 Discussion Questions (15 pts)	4/17/2011
12	Fault Diagnosis Team Assignment (20 pts) Week 12 Discussion Questions (15 points) Final Self/Team Assessment (5 pt) <b>System Validation Plan (Team Report) (80 pts)</b>	<b>4/24/2011</b>
13	Individual Final Exam (300 pts) End of Course Assessment	5/1/2011
	<b>Last Day of Semester (all work submitted by 11:59 pm)</b>	<b>5/6/2011</b>