ASE 6005 Syllabus

Systems Modeling with SysML, ASE 6005, Section QSY, 3 Credits

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Instructor Information

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General Course Information

Description

The Systems Modeling Language (SysML) has emerged as the de facto language of systems engineering when creating system models and is one of the three key enablers of Model-Based Systems Engineering. SysML is a general-purpose systems modeling language developed and standardized by the Object Management Group (OMG) that can be used for the specification, analysis, design, and verification of complex systems. The language provides graphical representations with a semantic foundation for modeling fundamental system concepts (e.g. traceability, whole-part composition, classification, interconnectivity, behavior, functional allocation, system of equations, etc.) expressed in four key system architecture viewpoints: requirements, behavior, structure, and parametrics[1].

ASE 6005 immerses students into the craft of systems modeling with SysML version 1. First, the course will provide students with a solid foundation in the semantics (i.e. meaning) and syntax (i.e. representation of meaning) of SysML as conveyed through the nine, interrelated diagram types so that they can understand and interpret models authored in SysML. Second, the course will provide students with practical guidance

leveraging best practices from the MBSE community and hands-on experience to create well-formed, executable systems models in SysML using the Magic System of Systems Architect (MSOSA)[2] tool and related plugins by Dassault Systèmes. Third, students will have the opportunity to work collaboratively using the MSOSA tool and companion TeamWork Cloud[3] collaboration, versioning, and model storage tool via a mini team project. Lastly, to ensure students are prepared for the future of MBSE, the course will include guided practice with the next generation systems modeling language, SysML version 2, through two live sessions where students will follow along with the instructor to discuss and apply core SysML version 2 language concepts.

Learning Outcomes

Upon successful completion of this course, you should be able to:

- Summarize the benefits and cost of MBSE
- Define what is a system model and explain its utility in the context of MBSE
- Summarize the role that SysML plays in MBSE
- Interpret information presented in all nine SysML diagram types
- Construct SysML models including one or more of the nine SysML diagram types to express fundamental system concepts using the MSOSA tool
- Simulate aspects of a SysML model using the Magic Model Analyst[4] tool and analyze the results of the simulation
- Collaboratively update a SysML model using MSOSA and the TeamWork Cloud tool via a mini team project
- Discuss core SysML version 2 language concepts and distinguish them from SysML version 1 constructs

Required Course Materials

Textbooks

Primary

A Practical Guide to SysML, Third Edition: The Systems Modeling Language, Sanford Friedenthal, Alan Moore, and Rick Steiner. Elsevier, 2015. (ISBN: 978-0128002025). Available online via the GT Library: A Practical Guide to SysML.

Secondary

SysML Distilled: A Brief Guide to the Systems Modeling Language, Lenny Delligatti. Addison-Wesley, 2013. (ISBN: 978-0321927866). Available online via the GT Library: SysML Distilled.

Software

This class uses the Magic System of Systems Architect (MSOSA) tool by CATIA Magic to develop SysML models. The software is provided free to all students enrolled in the course.

Experience has shown that computers owned by students vary tremendously in architecture (PC, Mac, Linux), operating system (Windows 10 or 11; macOS Sequoia or Sonoma; Fedora or Ubuntu), firewalls, and software tools installed. Rather than trying to debug the setup for each individual student, we have provided VLAB as the supported environment to launch and use MSOSA. VLAB can be accessed by going to https://mycloud.gatech.edu/, logging in with your Georgia Tech username and password, and opening the appropriate desktop. If you have problems accessing VLAB, contact GTPE Technical Support.

Grading Policy

Final grades in this course are determined by student performance across three types of graded work: individual weekly homework assignments (7 total), a collaborative team-modeling mini-project, and live session assignments (2 total). The course uses a point-based system where each assignment is worth 100 points, for a total of 1,000 points possible. Students can track their progress throughout the semester by calculating their cumulative point total and corresponding percentage.

Final course grades are awarded on a scale of A-F with no +/- grades permitted, as per Georgia Tech policy. The grade scale is as follows:

- **A:** 90% or higher
- **B:** 80-89%
- **C:** 70-79%
- **D:** 60-69%
- **F:** Below 60%

Assignments

Grading Type	Description of Graded Assignments	% Grade	Time to Complete (hr)
Homework 1	HW1: Organizing Models with Packages	12	4
Homework 2	HW2: Modeling Text-Based Requirements and Modeling Functionality with Use Cases	12	8
Homework 3	HW3: Modeling Structure with Blocks	12	20
Homework 4	HW4: Modeling Flow-Based Behavior with Activities	12	12
Homework 5	HW5: Modeling Constraints with Parametrics	12	12
Homework 6	HW6: Modeling Event Driven Behavior with State Machines and Modeling Message-Based Behavior with Interactions	12	12
Homework 7	HW7: Comprehensive Model	12	8
Team Mini-Project	Collaborative Team Modeling	6	4
Live Session 1	LS1: SysML v2 Kickstart, Part 1	5	4
Live Session 2	LS2: SysML v2 Kickstart, Part 2	5	4
	Total	**100**	**88**

Description of Graded Components

Homework Assignments (84% of final grade)

There are seven individual homework assignments throughout the semester, each worth 100 points (12% of the final grade). Homework assignments are cumulative in nature, with

each assignment building upon the previous one. Beginning with Homework 2, students will receive a starting SysML project file based on the solution model to the previous assignment, allowing them to continue developing and expanding their system model throughout the course.

Homework assignments are due on Mondays at 11:59 PM and will be graded and returned by the following Monday at 11:59 PM. Assignments include a variety of modeling and analysis tasks that build progressively throughout the course. Common task types include:

- **Modeling Statements:** Creating model diagrams and model elements from textual statements
- **Modeling Constructs:** Labeling modeling constructs
- **Style Rules:** Conforming to class modeling style

Additional tasks vary by assignment and may include project setup, behavioral descriptions, and model simulation and analysis tasks.

Each task within a homework assignment is assigned a number of points out of the total 100 points available. Most tasks are graded based on the following general rubric:

- **Full Credit:** Correct use of the language and fulfillment of the textual statement's intent; correct labeling of required modeling constructs; and correct application of class modeling style guide
- **Partial Credit:** Attempted task but falls short of correct application
- **No Credit:** Did not attempt task

Some tasks, such as project setup tasks, may be graded on a pass/fail basis as specified in the assignment instructions.

Collaborative Team-Modeling Mini-Project (6% of final grade)

The collaborative team-modeling mini-project is worth 100 points and provides students the opportunity to work collaboratively using the MSOSA tool and companion TeamWork Cloud tool. This assignment is graded on a pass/fail basis based on following the assignment instructions.

Live Session Assignments (10% of final grade)

There are two live session assignments, each worth 100 points (5% of the final grade). These assignments provide guided practice with SysML version 2, the next generation

systems modeling language. Students will follow along with the instructor to discuss and apply core SysML version 2 language concepts. Each assignment is graded on a pass/fail basis based on following the assignment instructions.

Course Policies

Attendance and/or Participation

This course is fully online with all lessons and tutorials pre-recorded. Weekly office hours and live sessions are optional to attend via Zoom or equivalent teleconferencing platform and will be recorded for playback at a more convenient time. All lesson and tutorial videos are available for the duration of the course and after. While live sessions are optional to attend synchronously, the associated assignments are required and graded. That being said, students who actively engage in the class by watching lesson and tutorial videos as well as regularly attending office hours and live sessions typically perform better on homework assignments than those who do not.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student

body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Prerequisites and Co-requisites

Prerequisites

There are no prerequisites for this course. However, students will have a higher chance of performing well if they possess the following:

- General knowledge in science, engineering, technology, and/or mathematics
- Systems engineering concepts such as requirements engineering and systems definition, design, and analysis
- Modeling and simulation concepts such as conceptual modeling, data architecting, and object-oriented programming

The following courses from the Professional Master's in Applied Systems Engineering curriculum are recommended to be taken prior to this course:

- ASE 6001 Fundamentals of Modern Systems Engineering
- ASE 6003 Modeling and Simulation for Systems Engineering

Co-requisites

There are no co-requisites for this course.

Extra Credit Opportunities

An optional assignment will be available after completion of Homework 6. The grade earned on this assignment will replace the lowest homework grade.

Collaboration, Group Work, and Use of Generative AI

Collaboration with peers and the use of generative AI tools is encouraged and permitted on all graded assignments in this course. Students may discuss modeling approaches, share insights, and use AI tools to support their learning. However, each student must submit their own original work that demonstrates their individual understanding of SysML concepts

and modeling practices. All students are expected to uphold the Georgia Tech Honor Code. Students should also follow the Georgia Tech Office of Information Technology's recommended guidance on AI.

Extensions, Late Assignments, and Re-Scheduled/Missed Exams

Due to the sequential dependency of homework assignments, extensions cannot be given, and late homework will not be accepted. Each assignment builds on the solution to the previous one, making timely completion essential for continued progress in the course.

Extensions for the team mini-project and live session assignments may be granted with sufficient advance notification. Students should contact the instructor as soon as possible if they anticipate difficulty meeting a deadline.

There are no exams in this course.

Additional Course Policies

Communication

- Canvas Discussions is the primary means of asking questions regarding course material and use of software tools
    - Be sure to review all Discussion posts before creating a new one
    - Do not post personal questions such as those regarding grades and/or assignment feedback
- Email communication with the instructor is recommended for any personal concerns, including questions about assignment grades or feedback
- Please communicate clearly with the instructor, mentors, and your classmates
    - Use correct spelling, punctuation, and grammar consistent with graduate level studies
    - Use respectful language

Recording of Course Activities

All live sessions and office hours conducted via Zoom will be recorded and made available to students for review as soon as possible. These recordings will remain available for the duration of the course.

Campus Holidays

ASE 6005 faculty (instructor and mentors) observe all campus holidays and may not respond to email or Canvas Discussion posts during these times. No assignments will be due on campus holidays. See the Georgia Tech academic calendar for the current official schedule.

Assignment Feedback and Grades

Students who have questions about their grades or feedback on assignments should first carefully review the assignment instructions and the solution model. If clarification is still needed, contact the instructor or mentor via email with specific questions about the grading.

Campus Resources for Students

Graduate Student Academic and Professional Success Resources

A list of resources for graduate students is given on the Office of Graduate and Postdoctoral Education website. Specific information for current graduate students includes:

- Academic Resources such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance;
- Student Resources such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide; and
- Professional Development such as the programming from the Career Center and other professional development resources and events.

Student Well-Being

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A comprehensive list of wellness related resources has been compiled and

maintained by the Office of the Vice President for Student Engagement and Well-being (student-resource-guide (gatech.edu)).

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1. SysML® Official Specifications | Object Management Group. (n.d.). Retrieved April 1, 2026, from https://www.omg.org/sysml/↩

2. Magic System of Systems Architect (MSOSA) is part of the CATIA Magic product line by Dassault Systèmes. (2023, May 22). https://www.3ds.com/products/catia/catia-magic↩

3. Teamwork Cloud. (2023, October 2). Dassault Systèmes. https://www.3ds.com/products/catia/no-magic/teamwork-cloud↩

4. Magic Model Analyst is part of the CATIA Magic product line by Dassault Systèmes. (2023, May 22). https://www.3ds.com/products/catia/catia-magic↩