Analysis and Synthesis of Information Systems

ASE6121 (Complex Systems Domain Elective)

Summer 2026

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Course Description:

This Complex Systems elective introduces Information Systems – Analysis and Synthesis. The course fully examines tools and approaches for analysis and synthesis of enterprise information systems. Topics include user-centered requirement, scenario-based design, UML, network/communications, iterative prototyping, and enterprise support.

Course Delivery:

This course will consist of a number of slides and recorded lectures, available through the Canvas website, each corresponding to weekly units. Those are intended for the education and introduction of topics to the students. In addition, I will be available for conversations and conferences with students, as requested. If there is enough of a request, I will start scheduling weekly video telecons (through skype or google hangouts – whatever consensus of the students is). Grades will be based on several assignments and projects.

Course Question:

The point of the course, as a guiding principle, is to answer this question – **"How do we analyze, model, design and maintain information systems (ISs) and associated data stores?"** This question will provide the focus of the information for the course, and we will attempt to answer it in a way that is meaningful to systems engineers.

Contact the instructor:

Email is the best route to contact me. The number above is my cell phone. I live in Newport News Virginia, but I support the GTRI Modeling and Simulation Facility, in Quantico, Virginia. I check email almost constantly through the day.

Textbooks:

None are required. The following may be useful, if the student is interested in additional information:

- Ulrich & Newcomb, *Information Systems Transformation: Architecture-Driven Modernization Case Studies*, 2010.
- Miles & Hamilton, *Learning UML 2.0*, 2006.
- Janert, *Data Analysis with Open Source Tools*, 2010.
- DAMA, *Data Management Body of Knowledge 2nd Ed.*, 2017

Course Grading:

As mentioned, the course grades are based, mainly, on three projects, and five homework assignments. In addition, there is a 10% portion of the grade that is based on class participation – in this course that will be based on the participation of the student in Peer Grading at the two on-site meetings (where projects will be presented. Overall, the grading will break down as follows:

Group Project Homework (Week 1) – 05%

Group Project Midterm Presentation – 30%
Peer Grading at Midterm on-site meeting – 05%

Group Project Final Presentation – 35%
Peer Grading at Final on-site meeting – 05%

Homework Assignments – 20%

Week 1 (Homework 1) – 5%
Week 2 (Homework 2) – 5%
Week 3 (Homework 3) – 5%
Week 5 (Homework 4) – 5%

- *Note, there is no Week 4,6,7 Homework, and no Week 7 Homework*

Topics:

The following topics will be covered as part of this course:

- Storage: Databases and SQL
- Open-Source Data and Data Visualization
- Looking at Data
- Modeling Data
- Mining Data
- UML and information systems modeling
- Data Processing and Programming (Introduction)
- Cyber-Physical Systems
- AI and Systems Engineering
- Information Systems Architectures
- Information Systems and CyberSecurity
- Networks
- Taxonomy for Systems Engineering
- Special Topics (could include encryption, information theory, cloud-based systems, etc)

Learning Objectives for the Course:

This course is split between two different perspectives. (1) is using Information Systems to help the systems engineering process. (2) is how to incorporate information systems into a system, and apply systems engineering techniques to modeling and analyzing it.

Because of that, the Learning Objectives are split between those two different areas.

- Be able to **DESCRIBE** and **DEFINE** the relationship between systems engineering and information systems.
- **EXHIBIT** familiarity with SQL and Database concepts, including basic data modeling.
- **UNDERSTAND** the seven-step data analysis process.
- **UNDERSTAND** systems modeling with paradigms and languages in addition to SysML.
- **EXHIBIT** familiarity with information systems modeling as part of the systems engineering process
- **DEFINE** the parts of an information system architecture and how it fits in to a more general system of systems.

Course Calendar:

Date	Topics	Homeworks/Projects
Week 1 –	• Introduction to IS • Introduction to Cyber Physical Systems • Introduction to Object Oriented Programming • Databases and SQL	**Group Project HW** – due by May 25 HW1 – due by May 18
Week 2 –	• Data: Introduction, Modeling, Mining • Data Classification, Features • Open Source Data • Data Visualization (1)	**HW2** –due by May 25
Week 3 –	• Information Systems Architectures (1) • UML: Modeling Information Systems (1)	**HW3** – due by Jun 01
Week 4 –	• Geographical Information • Social Networks Live Session – Present Project 1 (Jun 06, 07)	Midterm Project Presentations Jun 06-07
Week 5 –	• UML: Modeling Information Systems (2) • Big Data: Processing • Information System Architectures (2) • Data Visualization (2)	**HW4** – due by Jun 15
Week 6 –	• Networks • OSI Network Layer Model	
Week 7 –	Live Session – Present Project 2 (Jun 27, 28) • Wireless Networking (Special Topic) Insider Threat (Special Topic)	Final Project Presentations Jun 27-28

Course Projects:

1. Details to be posted later, but this will be your individual contribution to the project, although it should be based on (at least as far as data systems and data processing) part of what you will

contribute to the Group Project. The topic should be different, the same technique (so you get practice)

2. Details to be posted later, but this is your chance to present as part of your Team with students in the sensors and human factors classes. This is where you will contribute to the overall group project, and present and prepare the Information Systems part of the presentation.

Further details on the projects will be revealed through the semester.

Student Honor Code:

Students are reminded of the Georgia Tech Honor Code. Please see http://www.honor.gatech.edu. Any act of dishonesty will result in a Fail Grade.

Students with Disabilities:

Georgia Tech offers accommodations to students with disabilities. If you need a classroom accommodation, please make an appointment with the *ADAPTS* office (see http://www.adapts.gatech.edu).