New Jersey Institute of Technology

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Spring 2024

IS 676-852: Requirements Engineering

Sameh Sabet

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IS 676 - Requirements Engineering
Syllabus
Spring 2024

Instructor
Sameh Sabet
Department of Informatics
Ying Wu College of Computing
New Jersey Institute of Technology

Instructor	Sameh Sabet	Office	by appointment (please email first)
		Hours	Online Thursday, Friday 5pm-8pm
Office	N/A	Email	ssabet@njit.edu
Telephone	(732) 596-7704	Web Site	N/A
Fax		Course Site	Canvas

I.   COURSE SPECIFICATIONS

Course: IS 676
Course Title: Requirements Engineering
Prerequisite: IS 663/CS 673 - Software Design & Production Methodology OR
                      equivalent experience OR Permission of the Instructor.
Prepared: January 2024

II.   COURSE OVERVIEW

Requirements engineering is one of the all-important beginning stages of the systems development life cycle. Revealing and understanding the system's requirements is a crucial component of success for developing new computing systems or adjusting existing applications. This course covers the theory, principles, and practical application of the methodologies and tools for requirements engineering. The focus is development of large software systems and the integration of multiple systems into a comprehensive, domain dependent solution. All aspects of requirements engineering including the knowledge and skills needed to elicit and analyze requirements, translate these requirements into technical specifications, verify that the requirements accurately capture the system requirements, and manage software requirements through the system development cycle will be covered. Students will actively participate in discussions, labs and exercises, and prepare operational requirements and technical specifications for real-world problems. We will spend a considerable amount of time interacting and learning through discussion of assigned readings and other material.

III.   OUTCOMES EXPECTED UPON THE COMPLETION OF THE COURSE

Upon completion of this course, each student should be able to:

A. Explain the nature and scope of requirements engineering.

B. Contrast and compare techniques to elicit and document requirements.

C. Translate operational requirements into technical specifications and document them.

D. Apply the methods, tools, and techniques of structured analysis.

E. Apply the methods, tools, and techniques of object-oriented analysis.

F. Apply appropriate techniques to verify and validate requirements.

G. Apply the methods, tools, and techniques of requirements management.

H. Apply modern requirements engineering practices to Agile development methods and drive product backlogs using these methods.

IV. ACADEMIC INTEGRITY

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at:
http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu

V. GRADE STRUCTURE

ACTIVITY	POINTS
Exam	30
Project	40
Labs, Discussions and Participation	30
TOTAL POINTS	**100**

Generally speaking the final letter grades will follow a curve. While not an exact prescription, it is a pretty good guide.

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A           (25%)
B+          (25%)
B           (30%)
C+/C/F      (20%)
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VI   COURSE TEXTS AND READINGS

A. TEXTS

Required

> **None (online readings)**

Recommended

Software Requirements Engineering, Second Edition, R. Thayer and M. Dorfman, IEEE Press, ISBN 0-8186-7738-4

Exploring Requirements: Quality before Design, D. Gause and G. Weinberg, Dorset House, ISBN 0-932633-13-7

Managing Software Requirements: A Unified Approach, Dean Leffingwell and Don Widrig, Addison Wesley, ISBN 0-201-61593

Software Requirements, Karl E. Wiegers, Microsoft Press, ISBN 0-7356-0631-5

Introduction to the Personal Software Process, **Watts S. Humphrey, Addison Wesley, ISBN 0-201-54809-7**

B. READING ASSIGNMENTS (to be read before the indicated session)

Note: The readings listed below are open to change. I will continue to update (add/remove/modify) the readings if/when I find more relevant papers as the semester progresses. I will, however, keep you informed of the changes as they occur.

Session 1: Class Overview; Motivation for RE
Session 2: Introduction to Requirements Engineering
- *Software Requirements: A Tutorial* by Faulk (online)
- *Using Requirements Management to Speed Delivery of Higher Quality Applications* by Alan Davis and Dean Leffingwell (Online)

Session 3: The Rational Unified Process (RUP)
- *What Is the Rational Unified Process? by* Philippe Kruchten **(online).**
- *Rational Unified Process: Best Practices for Software Development Teams -* Rational Software White Paper (Online)
- *Applying Requirements Management with Use Cases* by Oberg et al. - Rational Software White Paper (Online)

Session 4: Requirements Elicitation I – Introduction; Methods and Techniques
- *Why Johnny Can't Write Requirements* by Ivy Hooks (Online)
- *Techniques for Requirements Elicitation* by Goguen and Linde (online) Requirements Elicitation II
- *Requirements Elicitation Methods for the Design of Interactive Systems* by Sabet (Online).

Session 5: Use Cases
- *Use Cases: the Pros and Cons,* By Donald G. Firesmith

- *Features, Use Cases, Requirements, Oh My!* by Dean Leffingwell - Rational Software White Paper (Online)
- *Use Cases -- Yesterday, Today, and Tomorrow* by Ivar Jacobson.
- User Stories | Examples and Template | Atlassian

Session 6: Requirements Analysis and the UML - Object-Oriented Analysis.
- *Object-Oriented Requirements Analysis & Design,* TutorialPoints
- *A UML Backgrounder* by Brian Talbert (Online)

Session 7: Documenting Specifications
- *Concept of Operations,* MITRE.org
- *IEEE Std P1233: Guide for Developing System Requirements Specifications* (Online)
- *IEEE Std 830: Recommended Practice for Software Requirements Specifications* (Online)

Session 8: Requirements Analysis – Structured Analysis and Formal Methods
- *Structured Analysis*, Tutorials Point
- *Structured Analysis*, Jeremy Rasmussen
- *Formal Methods*, Michael Collins
- *A Review of Formal Methods applied to Machine Learning*, Caterina Urban & Antoline Mine

Session 9: Verifying and Validating Software Requirements
- *GUIDELINES FOR VERIFYING AND VALIDATING SOFTWARE REQUIREMENTS AND DESIGN SPECIFICATION, Barry W. Boehm*
- *What is Requirements Traceability,* Requirements.com

Session 10: Managing Requirements
- *A Field Guide to Effective Requirements Management Under SEI's Capability Maturity Model* by Dean Leffingwell (Online)
- Extracts from *CMU/SEI-93-TR-25 – CMM Practices* (Online)
- *Managing Requirements* by Ivy Hooks (Online)
- *The Five Levels of Requirements Management Maturity* by Jim Heumann(online).

Session 11: Architecture
- *Abstractions for Software Architecture and Tools to Support Them, M. Shaw, R. DeLine, D. V. Llein, T.L. Ross, D. M.Young and G. Zelesnik, IEEE Transactions on Software Engineering, April 1995, V.21. No 4* **(Online).**

Session 12: Requirements Engineering for the Internet Age
- *A Comparison of RUP and XP* by John Smith - Rational Software White Paper (Online)
- *A Comparison of Requirements Engineering in Extreme Programming (XP) and Conventional Software Development Methodologies* by Cohn, T. M., and Paul, R. C., Proceedings of the 2001 Americas Conference on Information Systems, Boston, Massachusetts, 2001 (Online)
- *Scrum Guide*

Session 13:
  GORE

  "Structuring Use Cases with Goals"

- *Requirements Engineering: The Emerging Wisdom* by Jawed Siddiqi and M. Chandra Shekaran.

Session 14: Conclusions and Wrap-up
- *Requirements Engineering: A Roadmap* by B. Nuseibeh and S. Easterbrook, Proceedings of the International Conference on Software Engineering (ICSE-2000), 4-11 June 2000, Limerick, Ireland, ACM Press (Online)

VII. PROJECTS

The Projects are an opportunity for you to apply the concepts we will discuss throughout the semester to solve "real-world" problems. Working as a team, you are to demonstrate your mastery of the concepts, methods, tools, and techniques covered in class to elicit, analyze, establish, document, validate and manage requirements of a system of your choice, pending instructor approval. You will have access to Rational Analyst Studio templates to create, maintain and ultimately deliver the relevant requirements artifacts.

You will be required to view the project from many angles - customer, analyst, developer, tester, manager and end user. Initially, you will assume the role of the customer and communicate your needs and desired functionality of the system that is to be developed. You are not required to actually implement the system, however, the documents created must contain enough detail so that a third party would be able to implement the system as per the specifications.

Deliverables

1. **Project Proposal (2 points)**

2. **Vision Document including the Context Diagram (5 points)**
   Provide a statement of the problem and the suggested solution's vision and scope for instructor approval. This should include a Context Diagram showing the context of your proposed system. Ideally your team would have assumed the role of the customer and communicated to the analysts the needs and desired functionality of the system that is to be developed. The document should explain how the world would be a better place if your "new" product were in it. You must provide a comprehensive document that the instructor may or may not approve before further work can continue.

3. **Use Case Package including all major Use Cases and the context Use Case Diagram (8 points)**
   Provide the context Use Case Diagram and a summary document identifying all actors and their respective use cases. Further, a minimum of THREE major use cases per group member must be fully elaborated. You must provide a comprehensive document that the instructor may or may not approve and modify before further work can continue.

4. **Initial SRS Package including SRS, Supplementary Specifications and Glossary**
   Provide the complete software requirements specification (SRS) package and all supporting documentation (Vision doc., Use Cases, etc.) to another group. The documentation should be comprehensive enough so that the group can conduct a thorough verification and validation. This package will not be graded at this point. You will have a chance to incorporate the comments from the V and V stage and then submit the SRS for final grade.

5. **Verified and Annotated SRS (5 points)**
   Validate and verify another group's SRS using appropriate V and V mechanisms. A copy of the original SRS and the annotated version will need to be turned in to the instructor and to the reviewed group. Your group's grade will be based on the quality of your review of the provided SRS package.

6. **Final SRS Package including Vision Doc., Use Cases, SRS, Supplementary Specifications and Glossary (7 points)**
   Provide the final, corrected and complete package and all supporting documentation. You will have had a chance to incorporate the comments from the V and V stage at this point.

7. **Final Presentation (5 points)**
   Your group will present the project to the class at this time. Your presentation will give a general overview of the problem and the proposed solution system. You will also present the relevant Use Cases (via Use Case Diagrams). Another important aspect of your presentation should be the lessons learned from the project

8. **Team Rating (8 points)**

VIII. DISCUSSIONS

Your overall grade for this component will be based on the quality of your effort in leading and participating in class discussions and exercises.

Leading Class Discussion: You will be responsible in participating in online discussion on the week's theme for each class. This assumes you have thoroughly synthesized the information from the readings and has picked out a few relevant points to have a meaningful discussion. The purpose is not only to present your ideas, but also to elicit comments from the rest of the class in a meaningful discussion. A very useful way of doing this is by asking thought-provoking questions.

Each student is expected to post (on Canvas) TWO days ahead of time (i.e. before Monday of that week) at least TWO questions they would like the rest of the class to contemplate (especially while reading the articles for that class). Please be advised that posting questions late or not at all WILL affect your grade.

At the end of the week (Sunday), each student must then pick TWO questions posted to reply to with their thoughts.

Here is the grade point distribution for this component (20 points):

Online Participation	10 points
Posting Questions	10 points

IX. Grading

Late assignments submissions may be accepted for partial credit, with every day late accruing a 10% penalty.

As a rule of thumb, any assignment you submit to me will be graded and returned within a week.

Online discussion grades will be reflected/updated whenever any other deliverable is graded and posted.

X.   COURSE SCHEDULE

Session	Date	Topic	Projects Due Dates
1	01/16	Class Overview; Motivation for RE	
2	01/22	Introduction to Requirements Engineering	Groups Formed
3	01/29	The Rational Unified Process (RUP);	Project Proposal
4	02/05	Requirements Elicitation I – Introduction; Methods and Techniques Requirements Elicitation II	
5	02/12	Use Cases User Stories	# 1 – Vision Doc.
6	02/19	Requirements Analysis and the UML - Object-Oriented Requirements Analysis	
7	02/26	Requirements Documentation - Specifications	

8	03/04	Structured Analysis and Formal Methods	
NOTHING DUE	03/11	SPRING BREAK	
9	03/18	Requirements Verification and Validation	# 2 – Use Cases
10	03/25	Architecture	
11	04/01	Managing Requirements	Initial SRS
12	04/08	Requirements Engineering for the Internet Age	# 3 – Annotated SRS
13	04/15	Current Research	
14	04/22	**Presentations** **Conclusions/Wrap-up** Exam Prep	# 4 – Final Report
15	05/03	**Exam** Take Home/Online 48 hours to complete Over the weekend	

XI.   ANNOUNCEMENTS AND INSTRUCTIONS

Students are responsible for all postings on Canvas. Students should check Canvas at least two or three times a week for any updates. Any announcements or due dates on Canvas take precedence and are final.

NOTE: THE SCHEDULES AND PROCEDURES IN THIS COURSE ARE SUBJECT TO CHANGE IN THE EVENT OF EXTENUATING CIRCUMSTANCES. YOU WILL BE NOTIFIED OF DEVIATIONS.

XII. DISABILITY ACCOMODATIONS

If you are in need of accommodations due to a disability please contact Scott Janz, Associate Director of the Office of Accessibility Resources & Services (OARS), Kupfrian Hall 201, to discuss your specific needs. A Letter of Accommodation Eligibility from the OARS authorizing your accommodations will be required.