National University
of Computer & Emerging Sciences

Department of Computer Science

CS 3004 – Software Design and Analysis

Fall 2023

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Course Information

Program: BS (CS)   **Credit Hours:** 3   **Type:** Core
Pre-requisites (if any): CS2001 Data Structures, CL2001 Data Structures Lab
Course Website (if any): Google classroom will be used for announcements and course material.

Course Objectives

The objective of this course is to provide a detailed introduction to the important upstream SDLC phases of software analysis and design. Important concepts of the Object-Oriented (OO) paradigm (e.g. abstraction, encapsulation, inheritance, polymorphism, etc.) are covered and students are given an overview of the most widely used modeling language i.e. Unified Modeling Language (UML). Students are also exposed to design principles (e.g. SOLID) and the advanced topic of design patterns (creational, structural, and behavioral).

After studying this course, the students will be able to:

- Appreciate the importance of analysis and design in SDLC.
- Understand the basic pillars of the OO paradigm.
- Construct different static and dynamic OO analysis and design models of real-world applications using UML 2.x
- Create flexible and elegant designs of software systems using proven design principles and common design patterns.
- Translate OO design models to code using an OO programming language.

Course Grading (Tentative)

- Quizzes: 10%
- Project: 20%
- Midterm Exams: 30%
- Final Exam: 40%

Absolute grading scheme will be used for this course.

Course Textbook(s)

1. Object-Oriented Modeling and Design with UML, Michael R. Blaha and James R. Rumbaugh, 2nd Edition, Pearson, 2005.

2. Timothy C. Lethbridge, Robert Laganaiere , Object-Oriented Software Engineering (2nd Edition), McGraw-Hill, 2005

3. Object-Oriented Analysis and Design with Applications, Grady Booch et al., 3rd Edition, Pearson, 2007.

4. Software Engineering: A Practitioner's Approach, Roger S. Pressman, 6th Edition, McGraw-Hill, 2005.

5. Clean Architecture: A Craftsman's Guide to Software Structure and Design, 1st Edition, Robert C. Martin, Pearson, 2017.

6. Software Engineering: Theory and Practice, Shari Lawrence Pfleeger and Joanne M. Atlee, 4th Edition, Pearson, 2009.

7. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides, Pearson, 1995.

Tentative Weekly Schedule

S#	Topic	Week(s)	Project Deliverables
1	INTRODUCTION AND OVERVIEW SDLC Overview Role of Analysis and Design Development Paradigms Basic Concepts of OO Paradigm Benefits of OO Paradigm	1	
2A	ANALYSIS MODELING USING UML Use Case Diagrams and Descriptions Activity Diagrams Analysis Class Diagrams	2 – 5	Start of Week 3 Teams Formed Start of Week 4 Proposal End of Week 5 Phase 1: UCD, UCs, Analysis CD
	MIDTERM EXAM 1	6	
2B	ANALYSIS MODELING USING UML System Sequence Diagrams State Diagrams	6, 7	
3	DESIGN MODELING USING UML OOA to OOD Transition Design Class Diagrams Design Sequence Diagrams	8	
4	DESIGN CONCEPTS & PRINCIPLES Types of Cohesion & Coupling SOLID Principles	9	
5	MEASURING OO DESIGN QUALITY OO Metrics	10, 11	End of Week 11 Phase 2: Design CD, Design SDs
	MIDTERM EXAM 2	12	
6A	OO DESIGN PATTERNS	13	

	Definition		
	Description Template		
	Classification and Selection		
	Benefits and Drawbacks		
6B	CREATIONAL DESIGN PATTERNS Factory Method Singleton	13	
6C	STRUCTURAL DESIGN PATTERNS Composite Adapter	14	
6D	BEHAVIORAL DESIGN PATTERNS Observer Template Method	15	End of Week 15 Phase 3: Complete Executable Application
	PROJECT DEMOS	16	
	FINAL EXAM		

Course Policies

1. All students are expected to attend all lectures from beginning to end.
2. Students can contest their grades on quizzes and assignments ONLY within a week of the release of grades.
3. To pass this course, students should get at least 50% marks and 80% attendance.
4. Quizzes may be unannounced.
5. There is no make-up for a missed quiz.
6. Project-related assignments should be submitted on due date and time. The students can submit assignments within 48 hours with a 30% penalty. The assignment may not be accepted after 48 hours.
7. Cheating is strictly not allowed. If first instance is caught, you will be awarded negative marks. If the practice continues, the case will be referred to DC Committee for further action.
8. There may be multiple project related activities, therefore you are only allowed to form groups with students in the same section.
9. You are only allowed to give the quiz with your section, so students registered in section A will not be allowed to take quiz in section B and vice versa. The quizzes taken with different sections will not be checked and attendance may not be marked.