# Department of Computer Science

## CS3004 – Software Design & Analysis

## Fall 2022

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## Course Information

**Program:** BS                    **Credit Hours:** 3                    **Type:** Core
**Pre-requisites (if any):** Data Structures (course and lab)

## Course Description/Objectives/Goals:

Purpose of this course is to enable students to analyze, design and implement software systems and applications. The students learn these skills using the modern object-oriented paradigm, which promises reusable, readable and maintainable software components and applications.

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### Course Learning Outcomes (CLOs):

At the end of the course students will be able to:

1) Understand and appreciate the pillars and advantages of the OO paradigm.
2) Conduct a grammatical parse of a problem statement to identify the relevant abstractions (classes) and their attributes, operations, and relationships.
3) Analyze a given problem and model it using UML diagrams
4) Model the static aspects of a solution using a detailed UML design class diagram.
5) Model the dynamic aspects of a solution using different UML state and interaction- diagrams.
6) Produce elegant and flexible designs using the concept of design patterns.
7) Implement a given object-oriented design.
8) Understand and apply the fundamental design principles.

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## Course Textbook

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

**Additional references and books related to the course:**

- Blaha and Rumbaugh, Object-oriented Modeling and Design with UML (Second Edition), Pearson Prentice Hall 2005
- Erich Gamma, et al., Design Patterns: Elements of Re-usable Object-oriented Design, Addison-Wesley, 1999
- Martin Fowler, Refactoring: Improving the Design of Existing Code (First Edition), Addison-Wesley
- Robert C. Martin, Clean Architecture: A Craftsman's Guide to Software Structure and Design, Pearson 2017
- Grady Booch et al., Object-Oriented Analysis and Design with Applications (3rd Edition), Pearson 2007.
- Larman, Craig. Applying UML and patterns: an introduction to object oriented analysis and design and interative development. Pearson Education India, 2012.

## Tentative Weekly Schedule

| Week | Topics to be covered |
|------|----------------------|
| 1 | Intro + SDLC; Characteristics of good programs |
| 2 | OOP review, classes and objects; Inheritance, polymorphism, UML, is-a rule |
| 3 | Object associations (simple association, aggregation, composition; implementation; one to one, many to one, many to many; reflexive) |
| 4 | Multiple inheritance, diamond problem, Java interfaces, C++ virtual inheritance |
| 5 | Class diagrams |
| 6 | Use case diagrams, use case descriptions |
| 7 | Sequence diagrams, principles of choesion & coupling |
| 8 | State diagrams, Activity diagrams |
| 9 | Design principles (SOLID) 1 |
| 10 | Design principles (SOLID) 2 |
| 11 | Object-Oriented Metrics |
| 12 | Design patterns 1, 2 |
| 13 | Design patterns 3, 4 |
| 14 | Design patterns 5, 6 |
| 15 | Design patterns 7, 8 |

## (Tentative) Marks Distribution

1. Quizzes (10%)
2. Assignments (20%)
3. Midterm Exams (30%)
4. Final Exam (40%)

## Grading Scheme

Absolute grading will be used

## Course Policies

1. 80% attendance is required to appear in the exams
2. Plagiarism is not tolerable in any of its form. Minimum penalty would be an 'F' grade in the course. Students bear all the responsibility for protecting their assignments. In case of cheating, both parties will be considered equally responsible!
3. Assignments must be submitted in time. Late submissions (maximum one week) would result in deduction in marks. Only the submitted articles will be marked.