

IT3103: Object Oriented Analysis and Design (Compulsory)

BIT – 2nd YEAR – SEMESTER 3

INTRODUCTION

This is one of the two compulsory courses designed for Semester 3 of Bachelor of Information Technology Degree program. This course starts with object oriented concepts and moves towards the preparation of standard UML diagrams using an UML modeling tool.

CREDITS: 04

LEARNING OUTCOMES

After successfully completing this course you will be able to:

- Describe Object Oriented Analysis and Design concepts and apply them to solve problems
- Prepare Object Oriented Analysis and Design documents for a given problem using Unified Modelling Language

OUTLINE OF THE SYLLABUS

Topic	Minimum Number of hours
• Object Oriented Concepts	03
• Object Oriented Analysis and Modelling	02*
• Software Development Process	05
• Creating Use Case Diagrams	06*
• Identifying Classes ,Packages and drawing Class diagrams, Object Diagrams and Composite Structure Diagrams	09*
• Object Oriented Design and Modelling using UML	04*
• Working with State diagrams	03*
• Discovering Object Interactions	05*
• Working with Activity Diagrams	04*
• Component and Deployment Diagrams	01
• Case Studies	18*
Lectures	35
Practical and Tutorials	25
Total for the subject	60

* Students are expected to have a total of 25 hours of practicals and tutorials to strengthen their knowledge of these sections.

SYNOPSIS / OVERVIEW

This course is designed for students to analyze and design a problem domain in terms of objects by introducing and clarifying the fundamental ideas and basic concepts associated with object orientation. Object Oriented Analysis and Design (OOAD) method creates a set of models of a software system using UML to implement the identified requirements. This course strongly focus on helping the learner master OOAD through case studies that demonstrate key OO principles and patterns, while also applying the UML.

PEDAGOGICAL FRAMEWORK

The main pedagogical framework of the course focuses on instructions, teacher's notes, video lectures, and case studies to create an environment for the learner to learn through activities.

EXPECTATIONS / EXAMINATIONS / REQUIREMENTS

The learners are expected to obtain both theoretical and practical knowledge and master necessary skills to use object-oriented technologies in their further study, research and development work. Set of questions are provided to the learner at the end of the content of each section and two assignments are provided one at the end of the first half of the syllabus and the other at the end of the full syllabus. Marks for the activities and quizzes are not counted but marks for the assignments are tracked by the LMS and a pass grade is issued. Obtaining pass grades for the two assignments and Final Exam are mandatory for the completion of Semester 3.

REQUIRED MATERIALS

Main Reading

- **Ref1:** Systems Analysis and Design Methods by Jeffrey L. Whitten, Lonnie D. Bentley, 7th edition, ISBN 0-07-058224-6, Tata McGraw-Hill, 2007.
- **Ref2:** Teach Yourself UML in 24 Hours, Joseph Schmuller, 3rd Edition, ISBN 81-297-0609-1, Pearson Education, 2004
- **Ref3:** http://en.wikipedia.org/wiki/Software_development_process
- **Ref4:** http://en.wikipedia.org/wiki/Rational_Unified_Process

Supplementary Reading

- **Ref5:** UML 2 Bible , Tom Pender, Wiley Publishing, Wiley Publishing Inc, 2003
- **Ref6:** "UML User Guide", Grady Booch, James Rumbaugh, Ivar Jacobson, Addison Wesley, 2002.
- **Ref7:** Visual Modeling with Rational Rose 2002 and UML
By Terry Quatrani Foreword by Grady Booch, 2002

DETAILED SYLLABUS

1. Object Oriented Concepts (03 hrs.)

Instructional Objectives

- Distinguish between traditional methodologies and Object Oriented Methodologies
- Identify and describe the Object Oriented concepts

Material /Sub Topics

- 1.1 Introduction [Ref: Slides, Ref2: pg. 31]
- 1.2 System Concepts for Object Modelling [Ref2: pg. 32-43, Ref1: pg. 370-380]
 - 1.2.1 Classes, Objects
 - 1.2.2 Abstraction
 - 1.2.3 Inheritance
 - 1.2.4 Polymorphism
 - 1.2.5 Encapsulation
 - 1.2.6 Message Sending
 - 1.2.7 Association
 - 1.2.8 Aggregation

2. Object Oriented Analysis and Modelling (02 hrs.)

Instructional Objectives

- Define object modelling and explain its benefits
- Define Unified Modelling Language (UML) and its various types of diagrams

Material /Sub Topics

- 2.1 Introduction to Object Oriented Analysis [Ref1: pg. 370]
- 2.2 Introduction to Unified Modelling Language (UML) [Ref2: pg. 7-27]

3. Software Development Process (05 hrs.)

Instructional Objectives

- Recognize the benefits of a software development process
- Identify the different Process Models available
- Describe the stages of Rational Unified Process (RUP)

Material /Sub Topics

- 3.1 Introduction [Ref3]
- 3.2 Process Models [Ref3]
 - 3.2.1 Waterfall Processes
 - 3.2.2 Iterative Processes
 - 3.2.3 Formal Methods
- 3.3 Rational Unified Process [Ref4]

4. Creating Use Case Diagrams (06 hrs.)

Instructional Objectives

- Describe the benefits of Use-Case Modelling
- Define actors, use cases and use-case relationships
- Identify and describe the steps for preparing a use-case model

Material /Sub Topics

- 4.1 An Introduction to Use-Case Modelling [Ref1: pg. 244-250]
 - 4.1.1 Actors
 - 4.1.2 Use Cases
 - 4.1.3 Use Case Relationships
- 4.2 The Process of Requirements Use-Case Modelling [Ref1: pg. 251-262]
 - 4.2.1 Identify Business Actors
 - 4.2.2 Identify Business Requirements Use Cases
 - 4.2.3 Construct Use Case Model Diagram
 - 4.2.4 Document Business requirements Use-Case Narratives
 - 4.2.5 Use Cases and Project Management

5. Identifying Classes, Packages and drawing Class Diagrams, Object Diagrams and Composite Structure Diagrams (09 hrs.)

Instructional Objectives

- Recognize the concepts and notations used for finding Objects and Classes
- Identify the UML concepts of Stereotypes and Packages
- Draw Package Diagrams, Class Diagrams, Object Diagrams, and Composite Structure Diagrams
- Illustrate the definitions of relationships between classes in the system. Specifically, the concepts of Association and Aggregation
- Define Reflexive and Package relationships
- Illustrate the application of generalization and specialization principles to discover super class/subclass relationships

Material /Sub Topics

- 5.1 Visualizing a Class [Ref 2: pg. 47-56]
- 5.2 Working with Relationships [Ref 2: pg. 61-87, 225-229]
 - 5.2.1 Associations
 - 5.2.2 Inheritance and Generalization
 - 5.2.3 Class Diagrams and Object Diagrams
 - 5.2.4 Package Diagrams
 - 5.2.5 Understanding Aggregations, Composites, Composite Structure Diagrams
 - 5.2.6 Interfaces and Realizations

6. Object Oriented Design and Modelling using UML (04 hrs.)

Instructional Objectives

- Differentiate between the different types of object classes
- Identify the design relationships
- Define visibility and explain its three levels
- Recognize the concept of object responsibility and how it is related to message sending between object types
- Describe the activities involved in object-oriented design
- Differentiate between a design use-case narrative and an analysis use-case narrative
- Describe the object reusability and the use of design patterns

Material /Sub Topics

- 6.1 Design of an Object Oriented System [Ref1: pg. 647-651]
 - 6.1.1 Introduction
 - 6.1.2 Different types of Object Classes
 - 6.1.3 Design Relationships
 - 6.1.4 Attribute and Method Visibility
 - 6.1.5 Object Responsibilities
- 6.2 The Process of Object Oriented Design [Ref1: pg. 651-666]
 - 6.2.1 Refining the Use Case Model
 - 6.2.2 Modelling Class Interactions, Behaviours, and States that support use case scenario
 - 6.2.3 Updating the Object Model to Reflect the Implementation Environment
- 6.3 Object Reusability and Design Patterns [Ref1: pg. 666-671]

7. Working with State Diagrams (03 hrs.)

Instructional Objectives

- Draw state transition diagrams that provide additional analysis techniques for classes with significant dynamic behaviour

Material /Sub Topics

- 7.1 An introduction to State Diagrams [Ref2: pg. 123-130]
 - 7.1.1 Adding details to States
 - 7.1.2 Adding details to Transitions
 - 7.1.2.1 Events
 - 7.1.2.2 Actions
 - 7.1.2.3 Guard Conditions
 - 7.1.3 Substates
- 7.2 UML 2.0 State Diagrams [Ref2: pg. 130-131]
- 7.3 Importance of State Diagrams [Ref2: pg. 131-132]

8. Discovering Object Interactions (05 hrs.)

Instructional Objectives

- Add scenarios to the system to describe how Use Cases are realized as interactions among societies of objects
- Describe a scenario by applying sequence diagrams and communication diagrams

Material /Sub Topics

8.1 Sequence Diagrams [Ref2: pg. 135-153]

8.1.1 Introduction

8.1.2 Framing a Sequence Diagram in UML 2.0

8.2 Communication Diagrams [Ref2: pg. 157-168]

9. Working with Activity Diagrams (04 hrs.)

Instructional Objectives

- Model Use-Case activities using Activity Diagrams
- Identify and draw swimlanes in activity diagrams

Material /Sub Topics

9.1 Modelling the Use-Case activities using Activity Diagrams [Ref1: pg 390-394, Ref2: pg. 173-181]

9.2 New Concepts from UML 2.0 [Ref2: pg. 181-191]

10. Component and Deployment Diagrams (01 hr.)

Instructional Objectives

- Describe Component diagrams and Deployment diagrams that are used to graphically show the physical architecture of the software and hardware of the system

Material /Sub Topics

10.1 Component Diagrams [Ref2: pg. 197-209, Ref1: pg. 671-674]

10.2 Deployment Diagram [Ref2: pg. 213-222, Ref1: pg. 671-674]

11. Case Studies (18 hrs.)

Hardware and Software Requirements

Hardware

Any standard PC (Pentium)

Software

- Windows 95/98/2000/NT/XP/Vista
- ArgoUML OR Microsoft Visio OR Rational Rose 2002 OR any tool that supports UML 1.4 and higher

Examination Procedure

- Examination Paper will consist of two parts.
Part 1: 1 Hour paper consisting of Multiple Choice Questions
Part 2: 1 Hour Paper consisting of Structured Questions
- Students will be given two assignments during the semester. There will be multiple choice or structured questions based on these assignments.

Activities -

Please refer to the activities on the e-learning material in your Learning Management System (LMS)

Assessment -

You will get an online assignment, practice quizzes and online learning activities. The final exam will be conducted in a face to face environment.

Contact details -

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