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**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**

**WORK INTEGRATED LEARNING PROGRAMMES**

**COURSE HANDOUT**

**Part A: Content Design**

|  |  |
| --- | --- |
| **Course Title** | OBJECT ORIENTED ANALYSIS AND DESIGN |
| **Course No(s)** | SS ZG514 / SE ZG512 |
| **Credit Units** | 4 (1+ 1+ 2)  1 unit for class room hours, 1 unit for project hours, 2 units for student preparation.  Typically 1 unit translates to 32 hours |
| **Course Author** | Neena Goveas |
| **Version No** |  |
| **Date** |  |

**Course Objectives**

|  |  |
| --- | --- |
| **No** | Objective |
| **CO1** | Understand Object orientation concepts, theories and principles; |
| **CO2** | Understand Fundamental concepts of the object model; classes, objects, methods and messages, encapsulation and inheritance, interface and implementation, reuse and extension of classes, inheritance and polymorphism; |
| **CO3** | Understand the process of object-oriented requirements specification, analysis and design; Notations for object-oriented analysis and design; Case studies and applications using some object oriented programming languages |

**Text Book(s)**

|  |  |
| --- | --- |
| T1 | Larman, C., Applying UML and Patterns, Pearson Education, 2nd Ed., 2002. |
| T2 | Erich Gamma et al., Design Patterns: Elements of Reusable Object-Oriented Software, 1994 |

**Reference Book(s) & other resources**

|  |  |
| --- | --- |
| R1 | Martin, Robert C., Agile Software Development, Principles, Patterns, and Practices, 2002 |
| R2 | Ambler, Scott W., The Elements of UML(TM) 2.0 Style, Cambridge University Press, 2005 |
| R3 | <http://www.uml-diagrams.org> |
| R4 | <http://www.martinfowler.com> |
| R5 | <http://www.objectmentor.com> |

**Content Structure**

|  |  |
| --- | --- |
| **No** | **Title of the Module** |
| M1 | Introduction  SDLC Models - Waterfall, Unified Process, Agile  Introduction to Object Oriented Analysis & Design |
| M2 | Starting with Object Oriented Analysis : Building Use Case Model |
| M3 | Creating System Level Artefacts : Domain Model, SSD & Operation Contracts |
| M4 | Getting into Object Oriented Design : Refinements in Use Cases & Domain Model, Interaction Diagrams, State Transition Diagram, Activity Diagram |
| M5 | Visibility between Objects, Class Diagram, Package Diagram |
| M6 | Design Patterns : GRASP, Additional Patterns, SOLID Design Principles |
| M7 | Design Patterns : Some Gang Of Four (GoF) Patterns |
| M8 | Design Patterns : Further Gang Of Four (GoF) Patterns |

**Learning Outcomes:**

|  |  |
| --- | --- |
| No | Learning Outcomes |
| LO1 | Knowledge of Unified Process |
| LO2 | Knowledge of Unified Modeling Language |
| LO3 | The student should be able to apply the principles of object-oriented concepts using the Unified Process and Unified Modeling Language (UML) to any software development effort. |
| LO4 | Ability to recognize Design Patterns in a Software Product. |
| LO5 | Ability to recognize situations and fit software solutions to the problem. |

**Part B: Contact Session Plan**

|  |  |
| --- | --- |
| **Academic Term** | Second Semester 2021-2022 |
| **Course Title** | **OBJECT ORIENTED ANALYSIS AND DESIGN** |
| **Course No** | SS ZG514 / SE ZG512 |
| **Lead Instructor** | HS Jabbal |

## Glossary of Terms

1. Contact Hour (CH) stands for a hour long live session with students conducted either in a physical classroom or enabled through technology. In this model of instruction, instructor led sessions will be for 22 CH.
   1. Pre CH = Self Learning done prior to a given contact hour
   2. During CH = Content to be discussed during the contact hour by the course instructor
   3. Post CH = Self Learning done post the contact hour
2. Contact Hour (CS) stands for a two-hour long live session with students conducted either in a physical classroom or enabled through technology. In this model of instruction, instructor led sessions will be for 11 CS.
   1. Pre CS = Self Learning done prior to a given contact session
   2. During CS = Content to be discussed during the contact session by the course instructor
   3. Post CS = Self Learning done post the contact session
3. RL stands for Recorded Lecture or Recorded Lesson. It is presented to the student through an online portal. A given RL unfolds as a sequences of video segments interleaved with exercises
4. SS stands for Self-Study to be done as a study of relevant sections from textbooks and reference books. It could also include study of external resources.
5. LE stands for Lab Exercises
6. HW stands for Home Work.
7. M stands for module. Module is a standalone quantum of designed content. A typical course is delivered using a string of modules. M2 means module 2.

## Teaching Methodology (Flipped Learning Model)

The pedagogy for this course is centered around flipped learning model in which the traditional class-room instruction is replaced with recorded lectures to be watched at home as per the student’s convenience and the erstwhile home-working or tutorials become the focus of classroom contact sessions. Students are expected to finish the home works on time.

## Contact Session Plan

* Each Module (M#) covers an independent topic and module may encompass more than one Recorded Lecture (RL).
* Contact Sessions **(2hrs each week)** are scheduled alternate weeks after the student watches all Recorded Lectures (RLs) of the specified Modules (listed below) during the previous week
* In the flipped learning model, Contact Sessions are meant for in-classroom discussions on cases, tutorials/exercises or responding to student’s questions/clarification--- may encompass more than one Module/RLs/CS topic.
* Contact Session topics listed in course structure (numbered CSx.y) may cover several RLs; and as per the pace of instructor/students’ learning, the instructor may take up more than one CS topic during each of the below sessions.

## Detailed Structure

**Introductory Video/Document:** *<< Introducing the faculty, overview of the course, structure and organization of topics, guidance for navigating the content, and expectations from students>>*

* Each of the sub-modules of **Recorded Lectures** (RLx.y ) shall delivered via **30 – 60mins videos** followed by:
* **Contact session** (CSx.y) of 2Hr each for illustrating the concepts discussed in the videos with exercises, tutorials and discussion on case-problems (wherever appropriate); contact sessions (CS) may cover more than one recorded-lecture (RL) videos.

## Course Contents

**Contact Hour 1**

**M0: Introduction**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH |  | Not Applicable |  |
| During CH | CH1.1 | CS0.1 = Explanation of the material to be covered in this course |  |
| Post CH | SS1 | SS0.1 = Read Preface from Text: T1 |  |
| HW1 | HW0.1 = Visit <http://www.uml-diagrams.org> |  |
| LE1 | None |  |
| QZ1 | QZ0.1 = List the main diagram types available under uml 2.0 |  |

**Contact Hour 2**

**M0: Introduction**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL2.1 | None |  |
| During CH | CH2 | CS0.2 = Review of Object Oriented Programming |  |
| Post CH | SS2 | Object Oriented Programming/Approach | Internet |

**Contact Hour 3**

**M1: SDLC Models: Waterfall, Unified Process, Agile**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL3.1 | RL1.1.1 = Programming Paradigms – Procedural Programming, Object Oriented Programming – 10m  RL1.1.2 = What is Software Development Life Cycle (SDLC)? – 12m  RL1.1.3 = Waterfall Model: How it works? When to apply waterfall model? -15m |  |
| RL3.2 | RL1.2.1 = Overview of Unified Process – 12m  RL1.2.2 = UP : An Iterative & Evolutionary Development – 16m  RL1.2.3 = UP Phases & Disciplines – 16m |  |
| During CH | CH3 | CS1.1.1 = Explain with example difference between Procedural and Object Oriented Programming. Highlight the fact that, maintainability of software is easy in Object Oriented software.  CS1.1.2 = SDLC Phases, Role of Analyst, Designer, Programmer and Tester  CS1.1.3 = Waterfall Model : How it is good or bad?  CS1.1.4 = Briefing of all other models like Spiral Model, Incremental Model, V-Model etc.  CS1.1.5= UP Model, Phases & Disciplines, How it is different than Waterfall and other models? |  |
| Post CH | SS3 | SS1.1 = Read Ch 1 and Ch 2 of Text Book: T1  *Actual by Prof:*  *Ch 01 OOAD*  *Ch 02 Iterative, Evolutionary and Agile*  *Ch 03 Case Studies* | Larman  Chapter:  Part 1 Introduction |
| HW3 | HW1.1 = Download staruml from the Official Site. http://staruml.io/ |  |
| LE3 | LE1.1 = Read about the capability of staruml. |  |
| QZ3 | QZ1.1 = Write down the names of 11 kinds of uml diagrams supported by startuml. |  |

**Contact Hour 4**

**M1: SDLC Models: Waterfall, Unified Process, Agile**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL4.1 | RL1.3.1 = Agile Principles & Manifesto – 36n  RL1.3.2 = Xtreme Programming (XP) – 9m  RL 1.3.3 = Scrum – 15m  RL 1.3.4 = Agile Modelling – 9m  RL 1.3.5 = Test Driven Development – 10m  RL 1.3.6 = Refactoring & Continuous Integration -11m |  |
| RL4.2 | RL1.4.1 = Introduction to OOA & OOD? - 6m  RL1.4.2 = Overview of UML – 9m  RL1.5.1 = Concept of Class & Object – 13m  RL1.5.2 = Class Relationships in UML – 14m |  |
| During CH | CH4 | CS1.2.1 = Agile Model, Agile Manifesto, Various Agile approaches like Scrum, XP, TDD, Refactoring.  CS1.2.2= Give example of TDD and Refactoring in case of coding.  CS1.2.3 = Concept of Class, Object and their representation in UML |  |
| Post CH | SS4 | Ch 04 Inception is Not the Requirement Phase  Ch 05 Evolutionary Requirements  Ch 21 Test Driven Development and Refactoring  CH 22 UML Tools and UML as Blue Print | Larman  Part II Inception |
| HW4 | Browse the internet and find out very good video explaining Test Driven Development approach with some source code. |  |

**Contact Hour 5**

**M2: Starting with Object Oriented Analysis: Building Use Case Model**

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| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL5.1 | RL2.1.1 = Point of Sale (PoS) Case Study - 8m  RL2.1.2 = Requirement Categories – Functional & Non Functional Requirements – 10m  RL2.1.3 = What is Use Case Diagram & Use Cases? – 7m |  |
| RL5.2 | RL2.2.1 = Drawing Use Case Diagram for PoS -12m |  |
| During CH | CH5 | CS2.1.1 = Give mall example as PoS case study, First step in OOA is requirement gathering and requirement categorization (Functional & Non Functional)  CS2.1.2 = Explain difference between Use Case Diagram and Use Cases. Use Case Diagram is pictorial and Use Case is textual artefact.  CS2.1.3 = Demonstrate how Use Case Diagram can be drawn for PoS Case Study. |  |
| Post CH | SS5 | Ch 6- Use cases | Larman Chapter: Part II Inception |

**Contact Hour 6**

**M2: Starting with Object Oriented Analysis: Building Use Case Model**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL6.1 | RL2.3.1 = Types of Use Cases – 8m  RL2.3.2 = Write Fully Dressed Use Case for one scenario in PoS System. -17m  RL2.3.3 = Styles of Use Cases -6m |  |
| During CH | CH6 | CS2.2.1 = Explain Fully dressed use case syntax  CS2.2.2 = Demonstrate writing Fully Dressed Use Case for Process Sale scenario in PoS case study. |  |
| Post CH | SS6 | Ch 7- Other Requirements | Ch 7- Other Requirements |
| HW6 | HW2.1 = Go thru the Library Case study provided as a part of Courseware Kit. Draw Use Case Diagram and write fully dressed Use Case for any one scenario from Library Case Study. |  |

**Contact Hour 7**

**M3: Creating System Level Artefacts: Domain Model, SSD & Operation Contracts**

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| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL7.1 | RL3.1.1 = What is Domain Model?  RL3.1.2= How Domain Model is represented in UML?  RL3.1.3 = Identification of Domain Concepts from Use Case  RL3.1.4 = Identification of relationship among domain concepts  RL3.1.5 = Finding multiplicity among Domain Concepts  RL3.1.6= Adding attributes to Domain Model  RL3.1.7= Significance of Domain Model |  |
| During CH | CH7 | CS3.1.1 = Explain how Domain Concepts are different than software classes, how domain concepts to be identified?  CS3.1.2 = How to identify Associations and Multiplicity among domain concepts  CS3.1.3 = Explain how to add attributes to Domain Model?  CS3.1.4 = Demonstrate drawing complete Domain Model for PoS System |  |
| Post CH | SS7 | Ch 08 Iteration 1 - Baasics  Ch 09 Domain Models  Book:Larman Part III - Elaboration Iteration 1 - Basics |  |
| LE7 | LE3.1 = Draw Domain Model for Library Case Study. |  |

**Contact Hour 8**

**M3: Creating System Level Artefacts: Domain Model, SSD & Operation Contracts**

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| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL8.1 | RL3.2.1 = What is System Sequence Diagram?  RL3.2.2 = Drawing SSD for PoS  RL3.2.3= Significance of SSD |  |
| RL8.2 | RL3.3.1 = What is Operation Contract?  RL 3.3.2= Represent Operation Contract in UML  RL3.3.3 = Writing Operation Contract for PoS |  |
| During CH | CH8 | CS3.2.1 = Explain significance of SSD, Operation Contracts  CS3.2.2 = Demonstrate drawing SSD and writing operation contract for PoS System |  |
| Post CH | SS8 | Book:Larman Part III - Elaboration Iteration 1 - Basics  Ch 10 System Sequence Diagrams  Ch 11 Operation Contracts |  |
| LE8 | LE3.2 = Draw SSD for any once scenario of Library Case Study Pick up any  LE3.3 = one operation from SSD and write operation contract for the same. |  |
| QZ8 |  |  |

**Contact Hour 9**

**M4: Getting into Object Oriented Design : Refinements in Use Cases & Domain Model, Interaction Diagrams, State Transition Diagram, Activity Diagram**

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| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL9.1 | RL4.1.1 = Relating Use Cases : includes, extends relationships  RL4.1.2 = Refining Domain Model : Derived Attributes  RL4.1.3 = Refining Domain Model : Association Classes |  |
| RL9.2 | R RL4.2.1 = What is Interaction Diagram?  RL4.2.2 = Types of Interactions Diagrams  RL4.2.3 = Representation of Interaction Diagrams in UML  RL4.2.4= Drawing Interaction Diagrams for PoS |  |
| During CH | CH9 | CS4.1.1 = Explain how transition happens from Object Oriented Analysis to Object Oriented Design? How OOA artefacts gets utilized in OOD?  CS4.1.2 = Refinements done by Designer in Use Case Model & Domain Model  CS4.1.3 = Demonstrate refinements in already created Use Case Model and Domain Model for PoS System. |  |
| Post CH | SS9 | Book:Larman Part III - Elaboration Iteration 1 - Basics  Ch 12 Requirement to Design - Iteratively  Ch 13 NOT IN COURSE- Covered in Software Architecture Course  Ch 14 On to Object Design |  |
| LE9 | LE4.1 = Draw Sequence, Collaboration diagrams for any one scenario in Library Case Study |  |

**Contact Hour 10**

**M4: Getting into Object Oriented Design : Refinements in Use Cases & Domain Model, Interaction Diagrams, State Transition Diagram, Activity Diagram**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL10.1 | RL4.1.1 = Relating Use Cases : includes, extends relationships  RL4.1.2 = Refining Domain Model : Derived Attributes  RL4.1.3 = Refining Domain Model : Association Classes |  |
| RL10.2 | RL4.2.1 = What is Interaction Diagram?  RL4.2.2 = Types of Interactions Diagrams  RL4.2.3 = Representation of Interaction Diagrams in UML  RL4.2.4= Drawing Interaction Diagrams for PoS |  |
| During CH | CH10 | CS4.2.1 = Explain how an Interaction Diagram plays an important role in Blueprint of the software? Types and syntax of Interaction Diagrams?  CS4.2.2 = Demonstrate drawing Sequence Diagram, Collaboration Diagram for any one scenario of PoS System  CS4.2.3 = State Transition Diagram Syntax & Activity Diagram Syntax. What is different between them?  CS4.2.4 = Demonstrate drawing State Chart Diagram, Activity Diagram for PoS System. |  |
| Post CH | SS10 | Book:Larman Part III - Elaboration Iteration 1 - Basics  Ch 15 UML Interaction Diagrams  Ch 16 UML Class Diagrams  Ch 22 UML Tools and UML as Blueprint  Part V Elaboration Iteration 3 - Intermediate Topics  Ch 27 Iteration 3 - Intermediate Topics  Ch 28 UML Activity Diagrams and Modeling  Ch 29 UML State Machine Diagrams and Modeling  Ch 30 Relating Use Cases  Ch 31 Domain Model Refinement  Ch 32 More SSDs and Contracts |  |
| HW10 | HW4.1 = Refine the Domain Model and Use Case Model you created for Library Case Study. |  |
| LE10 | LE4.2 = Draw State Chart Diagram for Library as a whole system. Pick up any one key object in Library system and showcase how state transition happens for this object in any specific scenario.  LE4.3 = Pick up any one scenario in Library System and draw an Activity Diagram for the same. |  |

**Contact Hour 11**

**M5: Visibility between Objects, Class Diagram, Package Diagram**

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| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL11.1 | Review |  |
| During CH | CH11 | To be announced |  |
| Post CH | SS11 |  |  |
| HW11 |  |  |
| LE11 |  |  |
| QZ11 |  |  |
| Lab Reference |  |  |  |

**Contact Hour 12**

**M5: Visibility between Objects, Class Diagram, Package Diagram**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL12.1 | Review |  |
| During CH | CH12 | To be announced |  |
| Post CH | SS12 |  |  |
| HW12 |  |  |
| LE12 |  |  |
| QZ12 |  |  |
| Lab Reference |  |  |  |

**Contact Hour 13**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL13.1 | RL5.1.1 = What is Visibility among Objects  RL 5.1.2= Significance of finding Visibility  RL5.1.3 = Types of Visibility – Attribute, Parameter, Local & Global Visibility  RL5.1.4 = Attribute Visibility  RL5.1.5 = Parameter Visibility  RL5.1.6 = Local Visibility  RL 5.1.7= Global Visibility |  |
| RL13.2 | RL5.2.1 = Use Domain Model to draw Class Diagram  RL5.2.2 = Representing Class in UML  RL5.2.3 = Relationship among Classes in Class Diagram  RL5.2.4 = Guidelines to draw Class Diagram  RL5.2.5 = Draw Class Diagram for PoS System |  |
| During CH | CH13 | CS5.1.1 = Concept & Significance of Visibility among Objects  CS5.1.2 = Types of Visibility with source code example  CS1.1.3 = Transition from Domain Model to Class Diagram |  |
| Post CH | SS13 |  |  |
| HW13 | LE5.1 = Draw the Class and Package diagrams for Library System |  |
| LE13 | RL5.1.1 = What is Visibility among Objects  RL 5.1.2= Significance of finding Visibility  RL5.1.3 = Types of Visibility – Attribute, Parameter, Local & Global Visibility  RL5.1.4 = Attribute Visibility  RL5.1.5 = Parameter Visibility  RL5.1.6 = Local Visibility  RL 5.1.7= Global Visibility |  |
| QZ13 | RL5.2.1 = Use Domain Model to draw Class Diagram  RL5.2.2 = Representing Class in UML  RL5.2.3 = Relationship among Classes in Class Diagram  RL5.2.4 = Guidelines to draw Class Diagram  RL5.2.5 = Draw Class Diagram for PoS System |  |
| Lab Reference |  |  |  |

**Contact Hour 14**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL14.1 | RL5.3.1 = Grouping Classes in Package Diagram  RL5.3.2 = Level & Partitions for Package Diagram  RL5.3.3 = Showing Dependency in Package Diagram  RL5.3.4= Guidelines for Package Diagram  RL5.3.5= Drawing Package Diagram for PoS System |  |
| During CH | CH14 | CS5.2.1 = Drawing Class Diagram leveraging Domain Model drawn by an Analyst  CS5.2.2 = Demonstrate drawing Class Diagram for PoS System, show all types of visibility in Class Diagram  CS5.2.3= Drawing package class diagram for PoS System |  |
| Post CH | SS14 | HW5.1 = Browse the Internet and find out code snippets which will indicate all 4 types of visibilities, i.e. Attribute, Parameter, Local & Global visibility |  |
| HW14 | LE5.2 = Show all types of visibility in Class & Package Diagrams |  |
| LE14 |  |  |
| QZ14 | RL5.3.1 = Grouping Classes in Package Diagram  RL5.3.2 = Level & Partitions for Package Diagram  RL5.3.3 = Showing Dependency in Package Diagram  RL5.3.4= Guidelines for Package Diagram  RL5.3.5= Drawing Package Diagram for PoS System |  |
| Lab Reference |  |  |  |

**Contact Hour 15**

**M7: Design Patterns: Gang Of Four (GoF) Patterns**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL15.1 | RL6.1.1 = What is Pattern? What is Design Pattern?  RL6.1.2 = Types of Design Patterns : GRASP, GoF  RL6.1.3 = Advantages of using Design Patterns  RL6.1.4 = Design Patterns : Designer’s and Programmer’s perspective |  |
| RL15.2 | RL6.2.1 = What is Responsibility Assignment Problem?  RL6.2.2 = GRASP Patterns – Information Expert, Controller, Creator, Low Coupling & High Cohesion  RL6.2.3 = Information Expert Pattern – Problem & Solution  RL6.2.4 = Application of Information Expert in PoS System  RL6.2.5 = Controller Pattern – Problem & Solution  RL6.2.6 = Application of Controller Pattern in PoS System  RL6.2.7 = Creator Pattern – Problem & Solution  RL6.2.8 = Application of Creator Pattern in PoS System |  |
| RL15.3 | RL 6.3.1= Low Coupling Pattern – Problem & Solution  RL6.3.2 = Application of Low Coupling to optimize the design  RL6.3.3 = High Cohesion Pattern – Problem & Solution  RL6.3.4 = Application of High Cohesion Pattern to optimize the design |  |
| During CH | CH15 | CS6.1.1 = Explain meaning of Patterns, Design Patterns and how they matter for Programmers and Designers?  CS6.1.2 = Introduce 5 GRASP Patterns, problem and application of each pattern.  CS6.1.3 = Demonstrate the use of each of the GRASP pattern for PoS System |  |
| Post CH | SS15 |  |  |
| HW15 |  |  |
| LE15 |  |  |
| QZ15 |  |  |
| Lab Reference |  |  |  |

**Contact Hour 16**

**M7: Design Patterns: Gang Of Four (GoF) Patterns**

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| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL16.1 | RL6.4.1 = Additional Patterns : Polymorphism, Pure Fabrication, Indirection & Protected Variation  RL 6.4.2= Polymorphism Pattern – Problem & Solution  RL6.4.3 = Application of Polymorphism Pattern to optimize the design  RL6.4.4 = Pure Fabrication Pattern – Problem & Solution  RL6.4.5 = Application of Pure Fabrication Pattern to optimize the design  RL 6.4.6= Indirection Pattern – Problem & Solution  RL6.4.7 = Application of Indirection Pattern to optimize the design  RL6.4.8 = Protected Variation Pattern – Problem & Solution  RL6.4.9 = Application of Protected Variation Pattern to optimize the design |  |
| RL16.2 | RL6.5.1= Introduction to SOLID Design Principles  RL6.5.2= Single Responsibility Principle (SRP)  RL6.5.3= Open-Closed Principle (OCP)  RL6.5.4= Liskov Substitution Principle (LSP)  RL6.5.5= Interface Segregation Principle (ISP)  RL6.5.6= Dependency Inversion Principle (DIP) |  |
| During CH | CH16 | CS6.2.1 = Some more patterns (3 Ps and 1 I) and their application  CS6.2.2 = Demonstrate how these patterns will be used in PoS System  CS6.2.3= Overview of all Design Principles and their usage in real time examples |  |
| Post CH | SS16 |  |  |
| HW16 | HW6.1 = Find out scope of applicability of all 4 Design Principles in Library Case Study. |  |
| LE16 | LE6.1 = Refer other artefacts generated (Interaction Diagram, Class Diagram etc.) for Library System and identify how above learned patterns are getting applied over there. Make sure to cover each pattern studied. |  |
| QZ16 |  |  |
| Lab Reference |  |  |  |

**Contact Hour 17**

**M7: Design Patterns: Gang Of Four (GoF) Patterns**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL17.1 | RL 7.1.1= Adapter Pattern – Problem & Solution  RL7.1.2 = Application of Adapter Pattern to PoS  RL 7.1.3= Factory Pattern – Problem & Solution  RL7.1.4 = Application of Factory Pattern to PoS. |  |
| During CH | CH17 | CS7.1.1 = Introducing GoF Patterns  CS7.1.2 = Explain Adapter & Factory Patterns with help of coding example  CS7.1.3 = Showcase the use of above patterns in PoS System |  |
| Post CH | SS17 |  |  |
| HW17 |  |  |
| LE17 |  |  |
| QZ17 |  |  |
| Lab Reference |  |  |  |

**Contact Hour 18**

**M7: Design Patterns: Gang Of Four (GoF) Patterns**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL18.1 | RL 7.2.1= Singleton Pattern – Problem & Solution  RL7.2.2 = Application of Singleton Pattern to PoS.  RL 7.2.3= Strategy Pattern – Problem & Solution  RL7.2.4 = Application of Strategy Pattern to PoS. |  |
| During CH | CH18 | CS7.2.1 = Explain Singleton & Strategy Patterns with help of coding example  CS7.2.2 = Showcase the use of above patterns in PoS System |  |
| Post CH | SS18 |  |  |
| HW18 |  |  |
| LE18 | LE7.1 = Refer other artefacts generated (Interaction Diagram, Class Diagram etc.) for Library System and identify how above learned patterns are getting applied over there. Make sure to cover each pattern studied. |  |
| QZ18 |  |  |
| Lab Reference |  |  |  |

**Contact Hour 19**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL19.1 | RL 8.1.1= Composite Pattern – Problem & Solution  RL8.1.2 = Application of Composite Pattern to PoS.  RL 8.1.3= Facade Pattern – Problem & Solution  RL8.1.4 = Application of Facade Pattern to PoS. |  |
| During CH | CH19 | CS8.1.1 = Explain Composite & Facade Patterns with help of coding example  CS8.1.2 = Showcase the use of above patterns in PoS System |  |
| Post CH | SS19 |  |  |
| HW19 |  |  |
| LE19 |  |  |
| QZ10 |  |  |
| Lab Reference |  |  |  |

**Contact Hour 20**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL20.1 | RL 8.2.1= Observer/Delegation Event/Publish Subscribe Pattern – Problem & Solution  RL8.2.2 = Application of Publish Subscribe Pattern to PoS. |  |
| During CH | CH20 | CS8.2.1 = Explain concept of event source and event handler. How it is called as Observer as well as Publish-Subscribe Pattern?  CS8.2.2 = Explain above pattern by means of source code & event handling in UI  CS8.2.3 = Showcase the use of above pattern in PoS System |  |
| Post CH | SS20 | SS8.1 = Find out the list of GoF Patterns which you have not studied. Make list of such patterns in problem and solution format. |  |
| HW20 |  |  |
| LE20 | LE8.1 = Refer other artefacts generated (Interaction Diagram, Class Diagram etc.) for Library System and identify how above learned patterns are getting applied over there. Make sure to cover each pattern studied. |  |
| QZ20 |  |  |
| Lab Reference |  |  |  |

**Contact Hour 21**

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| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL21.1 | Review |  |
| During CH | CH21 | To be announced |  |
| Post CH | SS21 |  |  |
| HW21 |  |  |
| LE21 |  |  |
| QZ21 |  |  |
| Lab Reference |  |  |  |

**Contact Hour 22**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL22.1 | Review |  |
| During CH | CH22 | To be announced |  |
| Post CH | SS22 |  |  |
| HW22 |  |  |
| LE22 |  |  |
| QZ22 |  |  |
| Lab Reference |  |  |  |

**Lab work: Detailed Plan**

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| **Lab Objective** |
| For Library scenario described below (at the end of this document), do the following using Star UML tool where ever possible:   1. Requirement gathering    1. Identify the actors and their needs    2. Draw Use case diagram    3. Write use cases for Issue book & Return book 2. Analysis    1. Draw the domain model for the system    2. Draw activity diagram for Issue book    3. Identify the states of a book and draw a state transition diagram for Book 3. Design    1. Draw sequence diagrams to realize the use cases “Issue book” and “Return book”    2. Draw Software Class diagram based the analysis and design done 4. Evaluate quality of design    1. Given a software class diagram, evaluate the quality of the design based on the characteristics such as Coupling, cohesion, maintainability, etc. |

**Work integrated activities: Detailed plan**

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| **Activity description** |
| Choose a system developed in your organization. (Make sure the system is not chosen by any other group).   1. Understand the purpose, functions & features supported by the system. (You may have to meet & discuss with the team that has developed the system).   Submit a 1-page write up. Duration: 2 weeks   1. Understand the analysis & design of the system. (You may have to look at the design documents, speak to architect / designer).   Submit Domain model, System sequence diagram for 4 main use cases, Sequence diagram or Collaboration diagram for 4 main operations and Software class diagram consisting of main classes. Duration: 3 weeks   1. Make a presentation consisting of  * System overview * System analysis * Software design * Your observations on the quality of design (characteristics of good design) * Your recommendations to improve the design   Duration: 2 weeks |

**Project work: Detailed Plan**

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| **Objective of the project**: Apply OOAD techniques to design of software  **Tasks to be performed** by the students, in groups of 4:   1. Briefly describe a software application that you want to develop (1 week) 2. Define the requirements using Use case diagram and Use cases (1 week) 3. Analyze the requirements and create Domain model, State diagrams (2 weeks) 4. Draw the Sequence diagram for key use cases (2 weeks) 5. Draw the Software class diagram for the application (1 week) 6. Discuss: What were the key learnings from this assignment?   **Duration of the project**: 7 weeks  **Appendix:**  Product description document should contain:   1. Name of the product: 2. Purpose of the product: 3. Target users: 4. What pain point does the product try to alleviate: 5. Functions supported by the product: |

**Case studies: Detailed Plan**

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| --- | --- | --- |
| **Case study No** | **Case study Objective** | **Case study Sheet Access URL** |
| 1 | Demonstrate real life Use cases |  |
| 2 | Demonstrate real life artifacts such as Swim lane diagram, activity diagram and state diagrams |  |
| 3 | Demonstrate real life Sequence diagrams |  |
| 4 | Demonstrate real life Software Class diagram |  |

**Evaluation Scheme**:

Legend: EC = Evaluation Component; AN = After Noon Session; FN = Fore Noon Session

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No | Name | Type | Duration | Weight | Day, Date, Session, Time |
| EC-1 | Quiz-I/ Assignment-I | Online | - | 5% | February 1-15, 2021 |
|  | Quiz-II | Online |  | 5% | March 1-15, 2021 |
|  | Lab / Assignment | Online |  | 10% | April 1-15, 2021 |
| EC-2 | Mid-Semester Test | Closed Book | 2 hours | 30% | Sunday, 07/03/2021 (FN)  10 AM - 12 Noon |
| EC-3 | Comprehensive Exam | Open Book | 3 hours | 50% | Sunday, 02/05/2021 (FN)  9 AM – 12 Noon |

***Note*** *- Evaluation components can be tailored depending on the proposed model.*

## Important Information:

Syllabus for Mid-Semester Test (Closed Book): Topics in CS 1-5.

Syllabus for Comprehensive Exam (Open Book): All topics given in plan of study

Evaluation Guidelines:

1. For Closed Book tests: No books or reference material of any kind will be permitted. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.
2. For Open Book exams: Use of prescribed and reference text books, in original (not photocopies) is permitted. Class notes/slides as reference material in filed or bound form is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.
3. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam. The genuineness of the reason for absence in the Regular Exam shall be assessed prior to giving permission to appear for the Make-up Exam. Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.

It shall be the responsibility of the individual student to be regular in maintaining the self-study schedule as given in the course handout, attend the lectures, and take all the prescribed evaluation components such as Assignment/Quiz, Mid-Semester Test and Comprehensive Exam according to the evaluation scheme provided in the handout.