Savitribai Phule Pune University
Fourth Year of Information Technology (2015 Course)
414455: Software Design and Modeling

Teaching Scheme:	Credits: 03	Examination Scheme:
TH:03 Hours/Week		In-Sem (Paper): 30 Marks End-Sem (paper): 70 Marks

Prerequisites:

1. Problem Solving & Object-Oriented Programming.
2. Software Engineering and Project Management.
3. Database Management System.

Course Objectives:

1. To teach the student the fundamental aspects of different object oriented methodologies and unified approach along with Unified Modeling Language (UML), in terms of "how to use" it for the purpose of specifying and developing software.
2. Explore and analyze use case modeling, domain/ class modeling.
3. To teach the student Interaction and behaviour modeling.
4. Aware students with design process in software development.
5. Orient students with the software design principles and patterns.
6. Enable students to learn the architectural design guidelines in various type of application development.

Course Outcomes:

By the end of the course, students should be able to

1. Understand object oriented methodologies, basics of Unified Modeling Language (UML).
2. Understand analysis process, use case modeling, domain/class modeling
3. Understand interaction and behavior modeling.
4. Understand design process and business, access and view layer class design
5. Get started on study of GRASP principles and GoF design patterns.
6. Get started on study of architectural design principles and guidelines in the various type of application development.

Unit I	OBJECT ORIENTED METHODOLOGIES, UML	7 Hrs

Views of Software Developments: Traditional System Development Methodology and Object Oriented Analysis and Design, Importance Object –Orientation

Some of the object Oriented Methodology:- Object Oriented Design –Booch, Object Modeling Techniques – Rumbaugh, Object – Oriented Analysis - Cood Yourdon, Object – Oriented Software Engineering – Ivar Jacobson

Unified Approach: Object Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modeling Based on UML, Layered Approach,

Unified Modeling Language: Introduction to Modeling & UML, MDA, UML Structure, UML Building Blocks, UML Common Mechanisms, Introduction to all UML Diagram Notational Techniques, 4+1 View.

Unit II	OBJECT ORIENTED ANALYSIS	7 Hrs

Object Oriented Analysis Process,
Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Cases Identification, Communication, Uses/Include and Extend Associations, Writing a Formal Use Cases, Use Case realizations.
Domain / Class Modeling: Approaches For Identifying Classes (Noun-Phase Approach, Common Class Pattern Approach, Class Responsibilities Collaboration Approach, Naming Classes,
Class Associations and Identification of Associations, Generalization/Specialization Relationship, Aggregation and Composition Relationships, Attributes and Methods Identification.

Unit III	INTERACTION AND BEHAVIOR MODELING	7 Hrs

Activity Diagram : Activity and Actions, Initial and Final Activity, Activity Edge, Decision and Merge Points, Fork and Join, Input and Output Pins, Activity Group, Activity Partitions, Constraints on Action, Swim Lanes.
Sequence Diagram: Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions.
Collaboration Diagram: Objects and Links, Messages and stimuli, Active Objects, Communication Diagram, Iteration Expression, Parallel Execution, Guard Expression, Timing Diagram.
State Diagram: State Machine, Triggers and Ports, Transitions, Initial and Final State, Composite States, Submachine States.

Unit IV	OBJECT ORIENTED DESIGN	7 Hrs

Object Oriented Design Process
Designing Business Layer : Object Oriented Constraints Language (OCL), Designing Business Classes : The Process, Designing Well Defined Class Visibility, Attribute Refinement, Method Design Using UML Activity Diagram, Packaging and Managing Classes.
Designing Access Layer: Object Relational Systems, Object Relation Mapping, Table Class Mapping, Table – Inherited Classes Mapping, Designing the Access Layer Classes: The Process,
Designing View Layer: View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process, and Prototyping the User Interface.
Component and Deployment Design using Component and Deployment Diagram.

Unit V	DESIGN PRINCIPLES AND PATTERNS	7 Hrs

Introduction to Patterns
General Responsibility Assignment Software Patterns (GRASP) : Introduction, Creator , Information Expert, Low coupling, Controller, High Cohesion, Polymorphism , Pure fabrication, Indirection, Protected Variations.
Gang of Four (GoF): Introduction, Categories of Patterns (Creational, Structural and Behavioral Patterns), Singleton, Adapter, State, and Strategy.

Unit VI	ARCHITECTURAL DESIGN	7 Hrs

Overview of software Architecture, Designing Client / Server Software Architectures, Designing Service Oriented Software Architectures, Designing Component Based Software Architectures, Designing Concurrent and Real-Time Software Architectures, Designing Product Line Architectures, Related Case Studies.

Text Books

1. Ali Bahrami, Object Oriented System Development: Using Unified Modeling Language, McGraw-Hill, International Editions 1999,ISBN:0-07-116090-6.
2. Craig Larman, Applying UML and Patterns, Pearson Education, Second Edition,ISBN:978-0130925695.
3. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First Edition,ISBN:9789332555402, 9332555400.

Reference Books

1. Martin Fowler, UML Distilled, Pearson, Third Edition, ISBN:978-81-317-1565-9
2. Dan Pilone, Neil Pitman, UML in Nutshell, O'reilly Pub.,ISBN:8184040024, 9788184040029.
3. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill, Seventh Edition,ISBN: 9339212088, 9789339212087.
4. Hassan Gomaa, Software Modeling And Design UML, Use Cases, Pattern, & Software Architectures, Cambridge University Press, ISBN: 978-0-521-76414-8.
5. JIM Arlow, Ila Neustadt, UML 2 and the Unified Process, Pearson, Second Edition, ISBN: 9788131700549 Tom Pender, UML 2 Bible, Wiley India, ISBN: 9788126504527.