

Savitribai Phule Pune University

Third Year of Artificial Intelligence and Data Science (2019 Course)

Elective II

310254(D): Software Modeling and Architecture

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Teaching Scheme: Lecture: 04 Hours/Week##	Credit: 03	Examination Scheme: Mid-Semester (TH) : 30 Marks End-Sem (TH): 70 Marks
Prerequisites Courses: Object Oriented Programming (210243), Software Engineering (210253)		
Companion Course: Mini Project (317536)		
Course Objectives: <ul style="list-style-type: none"> • To understand and apply Object Oriented concept for designing Object Oriented based model or application • To transform Requirement document to appropriate design • To acquaint with the interaction between quality attributes and software architecture • To understand different architectural designs, transform them into proper model and document them • To understand software architecture with case studies and explore with examples, use of design pattern application 		
Course Outcomes: <i>On completion of the course, learners should be able to</i> <p>CO1: Analyze the problem statement (SRS) and choose proper design technique for designing web-based/ desktop application</p> <p>CO2: Design and analyze an application using UML modeling as fundamental tool</p> <p>CO3: Evaluate software architectures</p> <p>CO4: Use appropriate architectural styles and software design patterns</p> <p>CO5: Apply appropriate modern tool for designing and modeling</p>		
Course Contents		
Unit I	Concepts of Software Modeling	07 Hours
Software Modeling: Introduction to Software Modeling, Advantages of modeling, Principles of modeling. Evolution of Software Modeling and Design Methods: Object oriented analysis and design methods, Concurrent, Distributed Design Methods and Real-Time Design Methods, Model Driven Architecture (MDA), 4+1 Architecture, Introduction to UML, UML building Blocks, COMET Use Case–Based Software Life Cycle. Requirement Study: Requirement Analysis, SRS design, Requirements Modeling. Use Case: Actor and Use case identification, Use case relationship (Include, Extend, Use case Generalization, Actor Generalization), Use case template.		
#Exemplar/Case Studies	Requirement modeling and use case modeling for Real life applications (e.g., Online shopping system)	
*Mapping of Course Outcomes for Unit I	CO1, CO2	
Unit II	Static Modeling	07 Hours
Study of classes (analysis level and design level classes). Methods for identification of classes: RUP (Rational Unified Process), CRC (Class, Responsibilities and Collaboration), Use of Noun Verb analysis (for identifying entity classes, controller classes and boundary classes). Class Diagram: Relationship between classes, Generalization/Specialization Hierarchy, Composition and Aggregation Hierarchies, Associations Classes, Constraints. Object diagram, Package diagram, Component diagram, Composite Structure diagram, Deployment Diagram.		

#Exemplar/Case Studies	UML Static Diagrams for Real life applications (e.g., Online shopping system).	
*Mapping of Course Outcomes for Unit II	CO1 ,CO2	
Unit III	Dynamic Modeling	07 Hours
Activity diagram: Different Types of nodes, Control flow, Activity Partition, Exception handler, Interruptible activity region, Input and output parameters, Pins. Interaction diagram: Sequence diagram, Interaction Overview diagram, State machine diagram, Advanced State Machine diagram, Communication diagram, Timing diagram.		
#Exemplar/Case Studies	UML dynamic Diagrams of for Real life applications.	
*Mapping of Course Outcomes for Unit III	CO1 ,CO2	
Unit IV	Software Architecture and Quality Attributes	07 Hours
Introduction to Software Architecture, Importance of Software Architecture, Architectural Structure and Views. Architectural Pattern: common module, Common component-and-connector, Common allocation. Quality Attributes: Architecture and Requirements, Quality Attributes and Considerations		
#Exemplar/Case Studies	Case study of any real-life application	
*Mapping of Course Outcomes for Unit IV	CO3	
Unit V	Architectural Design and Documentation	07 Hours
Architecture in the Life Cycle: Architecture in Agile Projects, Architecture and Requirements, Designing an Architecture. Documenting Software Architecture: Notations, Choosing and Combining views, Building the documentation Package, Documenting Behavior, Documenting Architecture in an Agile Development Project.		
#Exemplar/Case Studies	Air Traffic Control.	
*Mapping of Course Outcomes for Unit V	CO4 , CO5	
Unit VI	Design Patterns	07 Hours
Design Patterns: Introduction, Different approaches to select Design Patterns. Creational patterns: Singleton, Factory, Structural pattern: Adapter, Proxy. Behavioral Patterns: Iterator, Observer Pattern with applications.		
#Exemplar/Case Studies	Flight Simulation	
*Mapping of Course Outcomes for Unit VI	CO4, CO5	
Learning Resources		
Text Books :		
1. Jim Arlow, Ila Neustadt, “UML 2 and the unified process –practical object-oriented analysis and design”, Addison Wesley, Second edition, ISBN 978-0201770605.		
2. Len Bass, Paul Clements, Rick Kazman, “Software Architecture in Practice”, Second Edition, Pearson ,ISBN 978-81-775-8996-2		

3. Erich Gamma, “Design Patterns”, Pearson, ISBN 0-201-63361-2.

Reference Books :

1. Hassan Gomaa, “Software Modeling and Design- UML, Use cases, Patterns and Software Architectures”, Cambridge University Press, 2011, ISBN 978-0-521-76414-8
2. Gardy Booch, James Rumbaugh, Ivar Jacobson, “The unified modeling language user guide” , Pearson Education, Second edition, 2008, ISBN 0-321-24562
3. Ian Sommerville, “Software Engineering”, Addison and Wesley, ISBN 0-13-703515-2

e-Books :

- <https://ebookpdf.com/roger-s-pressman-software-engineering>
- <https://dhamaseghanshyam.files.wordpress.com/2016/02/gomaa-softwaremodellanddesign.pdf>
- <https://balu051989.files.wordpress.com/2011/06/the-unified-modeling-language-user-guide-by-grady-booch-james-rumbaugh-ivar-jacobson.pdf>
- [http://index-of.co.uk/Engineering/Software%20Engineering%20\(9th%20Edition\).pdf](http://index-of.co.uk/Engineering/Software%20Engineering%20(9th%20Edition).pdf)

MOOCs Courses link

- <https://nptel.ac.in/courses/106/105/106105224/>
- https://onlinecourses.nptel.ac.in/noc20_cs59/preview
- https://onlinecourses.nptel.ac.in/noc20_cs84/preview

@ The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	-	3	-	-	-	-	-	-	1
CO2	1	1	3	-	3	-	-	-	-	-	-	1
CO3	1	1	2	1	2	-	-	-	-	-	-	1
CO4	1	1	3	2	3	-	-	-	-	-	-	1
CO5	1	1	3	-	3	-	-	-	-	-	-	2