Uka Tarsadia University

B. Tech.

Semester IV

SOFTWARE MODELING AND DESIGN
CE4019

EFFECTIVE FROM July-2022

Syllabus version: 1.00

Subject Code	Subject Title	Teaching Scheme			
		Hours		Credits	
		Theory	Practical	Theory	Practical
CE4019	Software Modeling and Design	3	2	3	1

Subject Code	Subject Title	Theory Examination Marks		Practical Examination Marks	Total Marks
		Internal	External	CIE	
CE4019	Software Modeling and Design	40	60	50	150

Objectives of the course:

- To deliver foundation of software modeling and design.
- To demonstrate the use of software process life cycle and design of software architectures.

Course outcomes:

Upon completion of the course, the student shall be able to,

CO1: Understand the foundation of software modeling methodologies.
CO2: Apply software life cycle models along with design and architectural concepts.
CO3: Apply use case and static modeling, and demonstrate object and class structuring.
CO4: Understand and apply dynamic interaction modeling and finite state machines.
CO5: Understand software architectures.
CO6: Apply software architectures on real-world applications.

Sr. No.	Topics	Hours
	Unit – I	
1	**Introduction to Software Modeling:** Object-Oriented methods and unified modeling language, Software architectural design, Methods and Notations, COMET, UML as a standard, Multiple views of software architecture, Evolution of Software Modeling and Design Methods, UML diagrams, Use Case diagrams, Classes and Objects, Class diagram, Interaction diagrams, State machine diagrams, Concurrent communication diagrams, Deployment diagrams.	5
	Unit – II	

2	**Software Life Cycle Models and Processes:** Software life cycle models, Design verification and validation, Software lifecycle activities, Software testing. **Software Design and Architectural Concepts:** Object-oriented concepts, Information hiding, Generalization, Concurrent processing, Design patterns, Software architecture and Components, Software quality attributes, COMET use-case based software life cycle, Comparison of COMET life cycle with other software processes, Requirements, Analysis, and Design modeling, Designing software architectures.	9
Unit – III		
3	**Use Case Modeling and Static Modeling:** Requirement modeling, Use cases, Actors, Identifying use cases, Documenting use cases, Use case relationships – Include and Extend, Use case structuring, Specifying non-functional requirements, Activity diagrams, Associations between classes, Composition and Aggregation hierarchies, Generalization and Specialization hierarchies, Constraints, Static modeling and the UML, Static modeling of the system context, Categorization of classes using UML stereotypes, Modeling external classes, Static modeling of entity classes. **Object and Class Structuring:** Object and Class structuring criteria, Modeling application classes and Objects, Object and class structuring categories, External classes and Software boundary classes, Boundary classes and objects, Entity classes and objects, Control classes and objects, Application logic classes and objects.	9
Unit – IV		
4	**Dynamic Interaction Modeling:** Object interaction modeling, Message sequence numbering on interaction diagrams, Dynamic interaction modeling, Stateless dynamic interaction modeling. **Finite State Machines:** Finite state machine and State transitions, State charts, Events and Guard conditions, Actions, Hierarchical state charts, Developing state charts from use cases.	4
Unit – V		
5	**Software Architecture:** Introduction to software architecture, Component based software architecture, Multiple views of a software architecture, Software architecture patterns, Documenting software architecture patterns, Interface design, Designing software architectures, Issues in	9

	software architecture design, Integrated communication diagrams, Separation of concerns in subsystem design, Subsystem structuring criteria.	
Unit – VI		
6	**Designing Software Architectures:** Designing Object-oriented software architectures, Designing client-server software architectures, Designing Component-based software architectures, Designing Concurrent and Real-time software architectures, Designing software product line architectures, Software quality attributes, Case studies of software architectures.	9

Sr. No.	Software Modeling and Design (Practicals)	Hours
1	To present study report on COMET method.	4
2	A detailed study on UML diagrams with application.	4
3	A study on object oriented modeling with application.	2
4	A study on class diagram with application.	4
5	A study on activity diagram with application.	4
6	To present non functional requirements on software system(s).	4
7	A study on software design patterns.	4
8	Case study on software architecture.	4

Text book:

1. Hassan Gomaa – “Software Modeling and Design” –Cambridge University Press.

Reference books:

1. Kamon Ayeva and Sakis Kasampalis, "Mastering Python Design Pattern", Packt Publication.
2. Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides, "Design Patterns", Addison Wesley.
3. Brian Allbee, "Hands-On Software Engineering with Python", Packt Publication.
4. Bernd Bruegge, Allen H. Dutoit, "Object-oriented Software Engineering Using UML, Patterns, and Java", Pearson.
5. Martin Fowler and Scott, "UML Distilled", Addison-Wesley.
6. Ian Sommerville, "Software Engineering", Pearson.
7. Mark Richards, "Software Architecture Patterns", O'Reilly.

Course objectives and Course outcomes mapping:

- To deliver foundation of software modeling and design: CO1, CO2, CO3, and CO5
- To demonstrate the use of software process life cycle and design of software architectures: CO2, CO3, CO4, CO5, and CO6

Course units and Course outcomes mapping:

Unit No.	Unit Name	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Introduction to Software Modeling	✓					
2	Software Life Cycle Models, and Software Design and Architectural Concepts		✓				
3	Use Case Modeling, Static Modeling, and Object and Class Structuring			✓			
4	Dynamic Interaction Modeling and Finite State Machines				✓		
5	Software Architecture					✓	
6	Designing of Software Architectures						✓

Programme outcomes:

PO 1: Engineering knowledge: An ability to apply knowledge of mathematics, science, and engineering.

PO 2: Problem analysis: An ability to identify, formulates, and solves engineering problems.

PO 3: Design/development of solutions: An ability to design a system, component, or process to meet desired needs within realistic constraints.

PO 4: Conduct investigations of complex problems: An ability to use the techniques, skills, and modern engineering tools necessary for solving engineering problems.

PO 5: Modern tool usage: The broad education and understanding of new engineering techniques necessary to solve engineering problems.

PO 6: The engineer and society: Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.

PO 7: Environment and sustainability: Articulate a comprehensive world view that integrates diverse approaches to sustainability.

PO 8: Ethics: Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.

PO 9: Individual and team work: An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give/receive clear instructions.

PO 11: Project management and finance: An ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: A recognition of the need for, and an ability to engage in life-long learning.

Programme outcomes and Course outcomes mapping:

Programme Outcomes	Course Outcomes					
	CO1	CO2	CO3	CO4	CO5	CO6
PO1	✓					
PO2		✓	✓	✓		
PO3						
PO4						
PO5		✓	✓	✓		
PO6						
PO7						
PO8						
PO9						
PO10			✓			
PO11						✓
PO12						