

UNIT I

Chapter 1 : Concepts of Software Modeling
1-1 to 1-44

Syllabus : 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.

1.1 Introduction to Software Modeling 1-1

1.1.1 Advantages of Modeling 1-2

1.1.2 Why do We Model ? 1-2

1.1.3 Benefits of Visual Modeling..... 1-3

1.1.4 Principles of Modeling..... 1-3

1.2 Evolution of Software Modeling and Design Methods 1-3

1.2.1 Object Oriented Analysis and Design Methods 1-4

1.2.2 Concurrent, Distributed Design Methods and Real-Time Design Methods..... 1-5

1.2.3 Model Driven Architecture (MDA)..... 1-6

1.2.4 4+1 Architecture..... 1-7

1.2.4(A) Why is it Called the 4 + 1 Instead of just 5 ?..... 1-8

1.2.4(B) 4+1 View of UML Diagrams..... 1-9

1.2.4(C) Why 4+1 Architecture 1-9

1.2.5 Introduction to UML..... 1-9

1.2.5(A) Introduction to Unified Modeling Language1-10

1.2.5(B) UML Supports Requirements Modeling.....1-11

1.2.6 UML Building Blocks1-11

1.2.6(A) Things in UML 1-11

1.2.6(B) Relationship in UML..... 1-14

1.2.6(C) Diagrams in UML 1-15

1.2.7 COMET Use Case - Based Software Life Cycle 1-15

1.3 Requirement Study 1-17

1.3.1 Types of Requirements..... 1-17

1.3.1(A) Functional Requirements 1-18

1.3.1(B) Non-Functional Requirements..... 1-18

1.3.2 Requirement Analysis 1-19

1.3.3 SRS Design 1-20

1.3.4 Organization of SRS Document 1-21

1.3.5 SRS for UMS (University Management System) 1-25

1.3.5(A) General Description..... 1-25

1.3.5(B) Overall Description..... 1-25

1.3.6 Specific Requirements 1-26

1.3.6(A) External Interface Required 1-26

1.3.6(B) Performance Requirements 1-26

1.3.6(C) Design Constraints..... 1-26

1.3.6(D) Attributes 1-26

1.3.6(E) Other Requirements..... 1-26

1.3.7 Requirements Modeling 1-27

1.3.8 Managing Changing Requirement 1-29

1.4 Use Case Modeling 1-30

1.4.1 Use Case Diagram..... 1-30

1.4.2 Actor and Use Case Identification..... 1-31

1.4.3 Use Case Relationship 1-33

1.4.3(A) Include..... 1-33

1.4.3(B) Extend..... 1-34

1.4.3(C) Use Case Generalization 1-35

1.4.3(D) Actor Generalization 1-36

1.4.4 Use Case Specification 1-37

1.4.5 Use Case Template 1-39

1.4.6 Solved Examples 1-41

UNIT II

Chapter 2 : Static Modeling 2-1 to 2-48

Syllabus : 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.

2.1 Introduction to Static Modeling..... 2-1

2.2 Study of Classes..... 2-1

2.3 Method of Identifying Classes..... 2-2

2.3.1 Rational Unified Process Model 2-2

2.3.2 CRC (Class Responsibilities Collaboration) 2-4

2.3.3 Use of Noun Verb Analysis 2-4

2.3.4 Common Class Pattern..... 2-6

2.3.5 Identifying Boundary, Entity and Control Classes..... 2-6

2.3.5(A) Boundary Class 2-6

2.3.5 (B) Control Classes..... 2-8

2.3.5 (C) Entity Classes..... 2-8

2.4 Class Diagram 2-9

2.4.1 Class Structure 2-9

2.4.2 Identifying Attributes2-11

2.4.3 Identifying Operation2-11

2.4.4 Relationship between Classes.....2-13

2.4.4(A) Association.....2-13

2.4.4(B) Generalization/Specialization Hierarchy.....2-15

2.4.4(C) Aggregate /Composite Hierarchy2-16

2.4.4(D) Composite Relationships.....2-17

2.4.5 Association Classes2-18

2.4.6 Constraints2-18

2.4.7 Solved Examples2-20

2.5 Object Diagram2-29

2.6 Package Diagram.....2-31

2.7 Component Diagram.....2-32

2.7.1 Types of Components / Elements of Component Diagram2-33

2.7.2 Interface.....2-34

2.8 Composite Structure Diagrams.....2-35

2.8.1 Part.....2-35

2.8.2 Port.....2-35

2.8.3 Interfaces2-36

2.8.4 Delegate2-36

2.9 Deployment Diagram2-37

2.9.1 Elements of a Deployment Diagram2-37

2.9.2 When to use Deployment Diagram2-37

UNIT III

Chapter 3 : Dynamic Modeling 3-1 to 3-39

Syllabus : 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.

3.1 Activity Diagram..... 3-1

3.1.1 Different Types of Nodes3-2

3.1.1(A) Initial and Final Activity3-2

3.1.1(B) Decision and Merge Points.....3-3

3.1.1(C) Forking and Joining3-3

3.1.2 Activity Edge / Control Flow.....3-4

3.1.3 Activity Partitions3-4

3.1.3(A) Swimlanes.....3-4

3.1.4 Exception Handler..... 3-5

3.1.5 Interruptible Activity Region 3-6

3.1.6 Input and Output Parameters And Pin 3-6

3.1.6(A) Input and Output Pins 3-6

3.1.7 Creating Activity Diagram 3-7

3.1.8 Solved Examples 3-8

3.2 Interaction Diagram..... 3-14

3.3 Sequence Diagram 3-15

3.3.1 Elements of Sequence Diagram.....3-16

3.3.1(A) Objects and Roles.....3-16

3.3.1(B) Link.....3-16

3.3.1(C) Object Life Line3-17

3.3.1(D) Message or Stimulus.....3-17

3.3.1(E) Focus of control3-18

3.3.1(F) End of a Lifeline3-18

3.3.1(G) Conditional Message3-18

3.3.2 Creating Sequence Diagram.....3-18

3.3.3 Modeling Interactions3-19

3.4 Interaction Overview Diagram..... 3-23

3.5 State Diagrams 3-23

3.5.1 Element of State Diagram3-24

3.5.1(A) State Machine3-24

3.5.1(B) Initial and Final State3-26

3.5.1(C) Triggers and Ports.....3-26

3.5.1(D) Transitions.....3-26

3.6 Advanced State Machine Diagram..... 3-27

3.6.1(A) Composite States.....3-27

3.6.1(B) Orthogonal State3-28

3.6.1(C) Submachine States3-29

3.7 Communication Diagram..... 3-35

3.8 Timing Diagram 3-36

UNIT IV

Chapter 4 : Software Architecture and Quality Attributes 4-1 to 4-13

Syllabus : 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

4.1 Introduction..... 4-1

4.2 Overview of Software Architecture 4-2

4.3 Architectural Structure and Views 4-3

4.3.1 Architectural Structure.....4-3

4.3.2 Architectural View4-3

4.4 Architectural Pattern..... 4-4

4.4.1 Common Module Patterns.....4-4

4.4.1(A) Layered Pattern.....4-4

4.4.2 Component and Connector Pattern4-5

4.4.2(A) The Broker Architectural Pattern.....4-5

4.4.2(B) Model-View-Controller Architectural Pattern.....4-5

4.4.2(C) Client Server Pattern4-6

4.4.2(D) Publish Subscribe Pattern4-7

4.4.2(E) Service Oriented Architecture Pattern.....4-8

4.4.3 Allocation Pattern4-9

4.4.3(A) Map Reduce Pattern.....4-9

4.4.3(B) Multi-tier Pattern4-9

4.5 Quality Attributes4-10

4.6 Architecture and Requirements.....4-11

4.7 Quality Attributes and Considerations4-12

UNIT V

Chapter 5 : Architectural Design and Documentation
5-1 to 5-8

Syllabus : 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.

5.1 Architecture in the Life Cycle 5-1

5.1.1 Architecture in Agile Projects 5-2

5.1.2 Architecture and Requirements 5-2

5.1.3 Designing an Architecture 5-3

5.1.3(A) Attribute Driven Design (ADD) 5-3

5.2 Documenting Software Architecture 5-5

5.2.1 Notations 5-5

5.2.2 Choosing and Combining View 5-5

5.2.3 Building the Documentation Package 5-6

5.2.4 Documenting Behavior 5-6

5.2.5 Documenting Architecture in an Agile Development Project 5-7

5.2.5(A) Architecture Decision Records 5-7

5.2.5(B) The C4 Model 5-7

UNIT VI

Chapter 6 : Design Patterns 6-1 to 6-22

Syllabus : Design Patterns : Introduction, Different approaches to select Design Patterns.

Creational patterns : Singleton, Factory,

Structural pattern : Adapter, Proxy.

Behavioral Patterns : Iterator, Observer Pattern with applications.

6.1 Design Patterns: Introduction..... 6-1

6.1.1 What is Design Pattern ?6-1

6.1.2 Why to Use Design Pattern ?6-1

6.1.3 Classification of Design Patterns6-2

6.1.3(A) Creational Design Patterns6-2

6.1.3(B) Structural Design Patterns6-3

6.1.3(B) Behavioral Design Patterns6-4

6.1.4 Design Pattern Template/
Documenting Design Pattern6-5

6.2 Different Approaches to Select Design Patterns..... 6-6

6.3 Creational Patterns 6-7

6.3.1 Singleton Pattern6-7

6.3.2 Factory Pattern.....6-8

6.4 Structural Pattern.....6-11

6.4.1 Adapter Pattern.....6-11

6.4.2 Proxy Pattern6-15

6.5 Behavioral Patterns6-17

6.5.1 Iterator Pattern6-18

6.5.2 Observer Pattern with Applications6-19

➤ **Case Studies C-1 to C-65**