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

**WORK INTEGRATED LEARNING PROGRAMMES**

**Digital Learning**

**Part A: Course Design**

|  |  |
| --- | --- |
| **Course Title** | SOFTWARE TESTING METHODOLOGIES |
| **Course No(s)** | SSZG552 |

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| --- | --- |
| **COURSE OBJECTIVES** | |
| **CO1** | The course aims at providing a sound conceptual foundation in the area of Software Testing Methodologies with emphasis on concepts and techniques for testing and analysis of software |
| **CO2** | The testing of software, at a unit, subsystem and system level. Various test techniques: specification based testing and code based testing. Techniques and methods for software test generation and validation. |
| **CO3** | The Software Analysis: Static and Dynamic. Test adequacy. Testing Object Oriented Software. The types of software testing: Regression and interoperability. The software test processes and management |

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| **LEARNING OUTCOMES** | |
| LO1 | Introduce the course and course handout. Bring a perspective of need and motivation for this course. Provide an overview of the course, quality attributes, levels and types of Testing |
| LO2 | Provide a base to the software testing techniques in form of mathematics and formal methods. Review topics of permutation/combination, discrete mathematics and graph theory. Focus is on the relevance to software testing. |
| LO3 | Bring an approach to look at the system from specification perspective. Learn the relevant techniques for testing specifications – Equivalence Class, Boundary Value Analysis, Combinatorial, Decision Tables and Domain Testing |
| LO4 | Take a code level approach to testing and assuring quality. Learn the relevant techniques for testing code – Path Based Testing and Data Flow Testing |
| LO5 | Introduce Model Based Testing. Various Model for Software testing, their choice and techniques. Learn Finite State Machine, Petri Nets and State Charts. Learn to use these to derive testing cases |
| LO6 | Understand the issues in OO Software Testing. Learn techniques and sublets of Unit, Integration and Systems Testing of OO Software. GUI Testing for OO Software |
| LO7 | Overview and need for Integration and Systems Testing of Software. Learn the techniques of Integration and Systems Testing |
| LO8 | Provide an overview from a life-cycle perspective of Software and Software Products. Agile Testing and Agile Model-Driven Development. Role of Test engineers in life-cycle-based testing |
| LO9 | Learn the need for test adequacy and need for enhancement of test cases. Various techniques and criteria for measuring of test adequacy (data and control flow). Using the criteria to enhance test cases. |
| LO10 | Explore and understand the need for minimization and prioritization. Review the regression test problem. Selection of test cases for regression. |

**Text Book(s)**

|  |  |
| --- | --- |
| T1 | Software Testing – A Craftsman’s Approach, Fourth Edition, Paul C Jorgenson, CRC Press |
| T2 | Foundations of Software Testing, Second Edition, Aditya P Mathur, Pearson |

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

|  |  |
| --- | --- |
| R1 | The Art of Software Testing, Third Edition, Glenford J. Myers, Tom Badget, Corey Sandler, |
| R2 | Software Testing and Quality Assurance – Theory and Practice, Kshirasagar Naik, Priyadarshi Tripathy, Wiley, 2013 |
| R3 | Testing Object Oriented Systems: Models, Patterns and Tools, Robert V Binder, Addison Wesley |
| R4 | Guide to Software Engineering Body of Knowledge, Version 3, IEEE |

**Content Structure**

Module Title: Introduction to Software Testing & Techniques

Session 1

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 1.1 | Introduction to Software Testing | Lecture Notes |
| 1.2 | Overview of the Course | Lecture Notes |
| 1.3 | Software Testing Techniques | T1 Chapter 1 & T2 Chapter 1 |
| 1.4 | Software Testing – Quality Attributes, Types and Levels | T1 Chapter 1 & T2 Chapter 1 |

Module Title: Mathematics & Formal Methods

Session 2

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 2.1 | Permutations and Combinations | Lecture Notes & Slides |
| 2.2 | Propositional Logic | T1 3.4 |
| 2.3 | Discrete Math | T1 Chapter 3 |
| 2.4 | Graph Theory | T1 Chapter 4 |

Module Title: Specification Based Testing

Session 3

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 3.1 | Specification Based Testing – Overview | Lecture Notes |
| 3.2 | Equivalence Class | T1 Chapter 6 |
| 3.3 | Boundary Value Analysis | T1 Chapter 5 |
| 3.4 | Example & Case Study | Lecture Notes, T1 Chapter 6 & 5 |

Module Title: Specification Based Testing

Session 4

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 4.1 | Domain Testing | T2 Chapter 3 |
| 4.2 | Combinatorial | Lecture Notes |
| 4.3 | Decision Table Based Testing | T1 Chapter 7 |
| 4.4 | Example & Case Study | T1 Chapter 7 & Lecture Notes |

Module Title: Code Based Testing

Session 5

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 5.1 | Code Based Testing – Overview | Lecture Notes |
| 5.2 | Path Testing | T1 Chapter 8 |
| 5.3 | Examples | T1 Chapter 8 |

Module Title: Code Based Testing

Session 6

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 6.1 | Data Flow Testing | T1 Chapter 9 |
| 6.2 | Path Based Testing – Metric | T1 Chapter 8 & Lecture Notes |
| 6.3 | Examples | T1 Chapter 9 & T1 Chapter 8 |

Module Title: Model Based Testing

Session 7

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 7.1 | Model Based Testing – Introduction & Overview | T1 Chapter 12 |
| 7.2 | Finite State Machines & Fault Model | T2 Chapter 5 |
| 7.3 | Examples | T1 Chapter 17 |
| 7.4 | Case Study | Lectures Notes & T1 Chapter 17 |

Module Title: Model Based Testing

Session 8

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 8.1 | Model Based Testing – Systems | T1 Chapter 17 |
| 8.2 | Model Based Testing – System of Systems | T1 Chapter 17 & T2 Chapter 5 |
| 8.3 | Example | T1 Chapter 17 & Lecture Notes |
| 8.4 | Cases Study | T1 Chapter 17 & Lecture Notes |

Module Title: Object Oriented Testing

Session 9

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 9.1 | OO Software & OO Software test – Introduction & Overview | Lecture Notes & T1 Chapter 15 |
| 9.2 | Issues in Testing OO Software | T1 Chapter 15 |
| 9.3 | OO Unit Testing | T1 Chapter 15 |
| 9.4 | Examples | T1 Chapter 15 & Lecture Notes |

Module Title: Object Oriented Testing

Session 10

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 10.1 | OO Integration Testing | T1 Chapter 15 |
| 10.2 | OO System Testing | T1 Chapter 15 |
| 10.3 | OO – GUI Testing | T1 Chapter 15 & Lecture Notes |
| 10.4 | Examples & Cases | T1 Chapter 15 & Lecture Notes |

Module Title: Integration Testing

Session 11

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 11.1 | Integration Testing – Introduction, Overview & Issues | T1 Chapter 13 |
| 11.2 | Integration Testing – Types & Strategies | T1 Chapter 13 |
| 11.3 | Examples | T1 Chapter 13 |
| 11.4 | Cases | T1 Chapter 13 & Lecture Notes |

Module Title: System Testing

Session 12

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 12.1 | System Testing – Introduction, Overview & Issues | T1 Chapter 14 |
| 12.2 | Systems Testing – Types, Techniques & Strategies | T1 Chapter 14 |
| 12.3 | Examples | T1 Chapter 14 & Lecture Notes |

Module Title: Life-Cycle Based Testing

Session 13

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 13.1 | Life-Cycle Based Testing – Overview and Perspective | T1 Chapter 11 |
| 13.2 | Life-Cycles – Water fall, Iterative, and Agile | T1 Chapter 11 |
| 13.3 | Implications and issues, Strategies & Models | T1 Chapter 11 |
| 13.4 | Example and Case | Lecture Notes |

Module Title: Test Adequacy and Enhancement

Session 14

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 14.1 | Test Adequacy – Need & Overview | T2 Chapter 7 |
| 14.2 | Test Adequacy Assessment – Data Flow | T2 Chapter 7 |
| 14.3 | Test Adequacy Assessment – Control Flow | T2 Chapter 7 |
| 14.4 | Examples & Cases | T2 Chapter 7 & Lecture Notes |

Module Title: Test Case Minimization, Prioritization & Optimization

Session 15

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 15.1 | Need, Motivation & Techniques | T2 Chapter 9 |
| 15.2 | Regression Testing – Test Selection (Execution Trace) | T2 Chapter 9 |
| 15.3 | Regression Testing – Test Selection (Dynamic Slicing) | T2 Chapter 9 |

Module Title: Test Case Minimization, Prioritization & Optimization

Session 16

|  |  |  |
| --- | --- | --- |
| Topic No. | Topic Title | Reference |
| 16.1 | Minimization, Prioritization & Optimization Techniques | T2 Chapter 9 |
| 16.2 | Test Selection Algorithms | T2 Chapter 9 |
| 16.3 | Examples | T2 Chapter 9 |

**Part B: Content Development Planning**

|  |  |
| --- | --- |
| **Course Title** | Software Testing Methodologies |
| **Course No** | SSZG552 |

Glossary of Terms:

1. Contact Hour (CH) stands for an 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 20 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. 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
3. 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.
4. LE stands for Lab Exercises
5. HW stands for Home Work will consists could be a selection of problems from the text.

**Contact Hour 1**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL1.1 | Introduction to Software Testing | Lecture Notes & Slides |
| Pre CH | RL1.2 | Overview of the Course | Lecture Notes & Slides |
| Pre CH | RL1.3 | Software Testing Techniques | T1 Chapter 1 & T2 Chapter 1 |
| Pre CH | RL1.4 | Software Testing – Quality Attributes, Types and Levels | T1 Chapter 1 & T2 Chapter 1 |
| During CH | CH1 | CH1.1 = Specification-Based Versus Code Based Testing debate  CH1.2 = Fault Taxonomies  CH1.3 = Requirements, Behaviour & Correctness  CH1.4 = Correctness Versus Reliability  CH1.5=Test Metrics | T1 1.4.3  T1 1.5  T2 1.3  T2 1.4  T2 1.6 |
| Post CH | SS1 | SS1.1 Quality Attributes  SS1.2 Test Techqniues |  |
| Post CH | HW1 | None |  |
| Post CH | LE1 | None |  |
| Post CH | QZ1 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 2**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL2.1 | Permutations and Combinations | Lecture notes & Slides |
| Pre CH | RL2.2 | Propositional Logic | T1 3.4 |
| Pre CH | RL2.3 | Discrete Math | T1 Chapter 3 |
| During CH | CH2 | CH2.1 = Examples for Permutations & Combinations  CH2.2 = Examples for Propositional Logic  CH2.3 = Examples on Set Theory  CH2.4 = Probability Theory | T1 Chapter 3  (Develop examples to understand the theory and its application from Software Testing Perspective) |
| Post CH | SS2 | SS2.1 Map Test Technique and Math Concepts  SS2.2 Study of Chapter 3 |  |
| Post CH | HW2 | None |  |
| Post CH | LE2 | None |  |
| Post CH | QZ2 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 3**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL2.4 | Graph Theory | T1 Chapter 4 |
| During CH | CH3 | CH3.1 = Graphs for testing – FSM  CH3.2 = Graphs for testing – Petri Nets  CH3.3 = Graphs for testing – EDPN  CH3.4 = Graphs for testing – StateCharts | T1 4.3.2  T1 4.3.3  T1 4.3.4  T1 4.3.5 |
| Post CH | SS3 | SS2.2 Study of Chapter 4 |  |
| Post CH | HW3 | None |  |
| Post CH | LE3 | None |  |
| Post CH | QZ3 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 4**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL3.1 | Specification Based Testing – Overview | Lecture Notes & T1 1.4.3 |
| Pre CH | RL3.2 | Equivalence Class | T1 Chapter 6 |
| Pre CH | RL3.3 | Boundary Value Analysis | T1 Chapter 5 |
| Pre CH | RL3.4 | Example & Case Study | Lecture Notes, T1 Chapter 6 & 5 |
| During CH | CH4 | CH4.1 = Discuss examples from the text  CH4.2 = Discuss and solve two examples from day to day software | T1 Chapter 5 & 6 |
| Post CH | SS4 | SS3.1 EC & BVA for a program  SS3.2 Analyse, Compare & Contrast the techniques |  |
| Post CH | HW4 | None |  |
| Post CH | LE4 | None |  |
| Post CH | QZ4 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 5**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL4.1 | Domain Testing | T2 Chapter 3 |
| Pre CH | RL4.2 | Combinatorial | Lecture Notes |
| Pre CH | RL4.3 | Decision Table Based Testing | T1 Chapter 7 |
| Pre CH | RL4.4 | Example & Case Study | T1 Chapter 7 & Lecture Notes |
| During CH | CH5 | CH5.1 = Discuss examples from the text  CH5.2 = Discuss and solve two examples from day to day software |  |
| Post CH | SS4 | SS4.1 = Elements of being systematic  SS4.2 = Compare & Contrast the test techniques |  |
| Post CH | HW5 | None |  |
| Post CH | LE5 | None |  |
| Post CH | QZ5 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 6**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL5.1 | Code Based Testing – Overview | Lecture Notes |
| Pre CH | RL5.2 | Path Testing | T1 Chapter 8 |
| Pre CH | RL5.3 | Examples | T1 Chapter 8 |
| During CH | CH6 | CH6.1 = Compound conditions  CH6.2 = Discussion on examples | T1 8.3.3  T1 8.3.4 or faculty discretion |
| Post CH | SS5 | SS5.1 Design of unit test cases  SS5.2 Explore the tools for testing and metrics |  |
| Post CH | HW6 | None |  |
| Post CH | LE6 | None |  |
| Post CH | QZ6 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 7**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL6.1 | Data Flow Testing | T1 Chapter 9 |
| Pre CH | RL6.2 | Path Based Testing – Metric | T1 Chapter 8 & Lecture Notes |
| Pre CH | RL6.3 | Examples | T1 Chapter 9 & T1 Chapter 8 |
| During CH | CH7 | CH7.1 = Discuss Coverage Metrics with examples  CH7.2 = Slice based testing | T1 9.1.7  T1 9.2 |
| Post CH | SS6 | At faculty discretion |  |
| Post CH | HW7 | None |  |
| Post CH | LE7 | None |  |
| Post CH | QZ7 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 8**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL7.1 | Model Based Testing – Introduction & Overview | T1 Chapter 12 |
| Pre CH | RL7.2 | Finite State Machines & Fault Model | T2 Chapter 5 |
| Pre CH | RL7.3 | Examples | T1 Chapter 17 |
| Pre CH | RL7.4 | Case Study | Lectures Notes & T1 Chapter 17 |
| During CH | CH8 | CH8.1 = Discuss Patterson Lattice  CH8.2 = Discuss an Example for FSM  CH8.3 =  CH8.4 = | T1 12.2  Faculty discretion |
| Post CH | SS7 | SS7.1 Compare & Contrast FSM, State Charts & Petri Nets  SS7.2 Using the FSM Model |  |
| Post CH | HW8 | None |  |
| Post CH | LE8 | None |  |
| Post CH | QZ8 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 9**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL8.1 | Model Based Testing – Systems | T1 Chapter 17 |
| Pre CH | RL8.2 | Model Based Testing – System of Systems | T1 Chapter 17 & T2 Chapter 5 |
| Pre CH | RL8.3 | Example | T1 Chapter 17 & Lecture Notes |
| Pre CH | RL8.4 | Cases Study | T1 Chapter 17 & Lecture Notes |
| During CH | CH9 | CH9.1 = Explain and discuss Systems of systems Types  CH9.2 = Examples of Systems of Systems | T1 17.2 |
| Post CH | SS8 | SS8.1 Explore Systems of Systems around us |  |
| Post CH | HW9 | None |  |
| Post CH | LE9 | None |  |
| Post CH | QZ9 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 10 (Review Session)**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | All QR videos | QR1 to QR8 | These are all Quick Review Sessions |
| During CH | CH10 | CH10.1 = Review of Modules 1 to 8  CH10.2 = Problem solving and Q&A |  |
| Post CH | SS10 | At the faculty discretion |  |
| Post CH | HW10 | None |  |
| Post CH | LE10 | None |  |
| Post CH | QZ10 | At the faculty discretion |  |

Notes:

**Contact Hour 11**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL9.1 | OO Software & OO Software test – Introduction & Overview | Lecture Notes & T1 Chapter 15 |
| Pre CH | RL9.2 | Issues in Testing OO Software | T1 Chapter 15 |
| Pre CH | RL9.3 | OO Unit Testing | T1 Chapter 15 |
| Pre CH | RL9.4 | Examples | T1 Chapter 15 & Lecture Notes |
| During CH | CH11 | CH11.1 = Discuss implications of Composition & Encapsulation on from Test Perspective  CH11.2 = Discuss implications of Inheritance & Polymorphism from Test Perspective | T1 15.1.2  T1 15.3.4  Addition info at Faculty discretion |
| Post CH | SS9 | SS9.1 OO Test methods for a program  SS9.2 Review of a OO Framework (Qt/GTK) and OO Testing |  |
| Post CH | HW11 | None |  |
| Post CH | LE11 | None |  |
| Post CH | QZ11 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 12**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL10.1 | OO Integration Testing | T1 Chapter 15 |
| Pre CH | RL10.2 | OO System Testing | T1 Chapter 15 |
| Pre CH | RL10.3 | OO – GUI Testing | T1 Chapter 15 & Lecture Notes |
| Pre CH | RL10.4 | Examples & Cases | T1 Chapter 15 & Lecture Notes |
| During CH | CH12 | CH12.1 = Discuss Framework for OO integration testing  CH12.2 = Discuss Use Case based System Testing for OO software (Currency converter program) | T1 15.4.3  T1 15.5.1 |
| Post CH | SS10 | At Faculty discretion |  |
| Post CH | HW12 | None |  |
| Post CH | LE12 | None |  |
| Post CH | QZ12 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 13**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL11.1 | Integration Testing – Introduction, Overview & Issues | T1 Chapter 13 |
| Pre CH | RL11.2 | Integration Testing – Types & Strategies | T1 Chapter 13 |
| Pre CH | RL11.3 | Examples | T1 Chapter 13 |
| Pre CH | RL11.4 | Cases | T1 Chapter 13 & Lecture Notes |
| During CH | CH13 | CH13.1 = Examples of Call Graph Based Integration  CH13.2 = Examples of Path Based Integration | T1 13.2  T1 13.3 |
| Post CH | SS13 | SS11.1 Integration strategies for a GUI program |  |
| Post CH | HW13 | None |  |
| Post CH | LE13 | None |  |
| Post CH | QZ13 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 14**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL12.1 | System Testing – Introduction, Overview & Issues | T1 Chapter 14 |
| Pre CH | RL12.2 | Systems Testing – Types, Techniques & Strategies | T1 Chapter 14 |
| Pre CH | RL12.3 | Examples | T1 Chapter 14 & Lecture Notes |
| During CH | CH14 | CH14.1 = Coverage Metrics for System Testing  CH14.2 = Non Functional System Testing  CH14.3 =  CH14.4 = | T1 14.7  T1 14.9 |
| Post CH | SS12 | At faculty discretion |  |
| Post CH | HW14 | None |  |
| Post CH | LE14 | None |  |
| Post CH | QZ14 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 15**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL13.1 | Life-Cycle Based Testing – Overview and Perspective | T1 Chapter 11 |
| Pre CH | RL13.2 | Life-Cycles – Water fall, Iterative, and Agile | T1 Chapter 11 |
| Pre CH | RL13.3 | Implications and issues, Strategies & Models | T1 Chapter 11 |
| Pre CH | RL13.4 | Example and Case | Lecture Notes |
| During CH | CH15 | CH15.1 = Discuss Agile methods and processes for Test Engineers (TDD, XP, Scrum)  CH15.2 =  CH15.3 =  CH15.4 = | Take up an exercise in class for team understanding with use of a sport or a team game |
| Post CH | SS13 | SS13.1 Agile Methodologies – Mechanisms and Tools |  |
| Post CH | HW15 | None |  |
| Post CH | LE15 | None |  |
| Post CH | QZ15 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 16**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL14.1 | Test Adequacy – Need & Overview | T2 Chapter 7 |
| Pre CH | RL14.2 | Test Adequacy Assessment – Data Flow | T2 Chapter 7 |
| During CH | CH16 | CH16.1 = Concepts, Adequacy criteria for data flow – focus on examples | T2 7.3/7.4 |
| Post CH | SS14 | At faculty discretion |  |
| Post CH | HW16 | None |  |
| Post CH | LE16 | None |  |
| Post CH | QZ16 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 17**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL14.3 | Test Adequacy Assessment – Control Flow | T2 Chapter 7 |
| Pre CH | RL14.4 | Examples & Cases | T2 Chapter 7 & Lecture Notes |
| During CH | CH17 | CH17.1 = Concepts, Adequacy criteria for control flow – focus on examples | T2 7.2 |
| Post CH | SS17 | At faculty discretion |  |
| Post CH | HW17 | None |  |
| Post CH | LE17 | None |  |
| Post CH | QZ17 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 18**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL15.1 | Need, Motivation & Techniques | T2 Chapter 9 |
| Pre CH | RL15.2 | Regression Testing – Test Selection (Execution Trace) | T2 Chapter 9 |
| Pre CH | RL15.3 | Regression Testing – Test Selection (Dynamic Slicing) | T2 Chapter 9 |
| During CH | CH19 | CH19.1 = Execution Trace Example  CH19.2 = Dynamic Slicing example | T2 9.5  T2 9.6 |
| Post CH | SS15 | SS15.1 Compare and Contrast Execution Trace & Dynamic Slicing |  |
| Post CH | HW19 | None |  |
| Post CH | LE19 | None |  |
| Post CH | QZ18 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 19**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | RL16.1 | Minimization, Prioritization & Optimization Techniques | T2 Chapter 9 |
| Pre CH | RL16.2 | Test Selection Algorithms | T2 Chapter 9 |
| Pre CH | RL16.3 | Examples | T2 Chapter 9 |
| During CH | CH19 | CH19.1 = Pairwise – OATS as a reduction technique  CH19.2 = Latin Squares | T2 6.6 & 6.8  T2 6.4 |
| Post CH | SS16 | SS16.1 Compare and Contrast use of combinatorial techniques for test reduction |  |
| Post CH | HW19 | None |  |
| Post CH | LE19 | None |  |
| Post CH | QZ19 | Suitable quiz may be designed for the topics covered |  |

Notes:

**Contact Hour 20**

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Type | Sequence | Content Reference |
| Pre CH | All QR videos | QR9 to QR16 | These are all Quick Review Sessions |
| During CH | CH20 | CH12.1 = Review of Modules 9 to 16  CH12.2 = Problem solving and Q&A |  |
| Post CH | SS20 | At the faculty discretion |  |
| Post CH | HW20 | None |  |
| Post CH | LE20 | None |  |
| Post CH | QZ20 | At the faculty discretion |  |

Notes: