



**BITS Pilani**  
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## **BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI WORK INTEGRATED LEARNING PROGRAMMES**

### **COURSE HANDOUT Part A: Content Design**

<b>Course Title</b>	Software Quality Assurance and Testing
<b>Course No(s)</b>	SE ZG501
<b>Credit Units</b>	4
<b>Course Author</b>	Bhaskar Zeminder
<b>Version No</b>	1.0
<b>Instructor –in-Charge</b>	Rajesh S
<b>Date</b>	29- July-2023

#### **Course Objectives**

No	Objective
<b>CO1</b>	Develop a comprehensive understanding of software quality assurance principles, methodologies, and industry best practices to ensure the delivery of high-quality software products
<b>CO2</b>	Master the various techniques and tools used in software testing, verification, and validation to effectively identify and rectify defects throughout the software development lifecycle.
<b>CO3</b>	Analyse and apply advanced quality assurance strategies such as test automation, continuous integration, and agile testing, to enhance the efficiency and effectiveness of software development teams in delivering top-notch software products

#### **Textbook(s)**

T1	Software Quality Assurance Book by Alain April and Claude Y. Laporte
T2	Software Quality Assurance (From Theory to Implementation) by Daniel Galin

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

R1	Software Quality Assurance By Ivan Mistrik, Richard M Soley, Nour Ali, John Grundy, Bedir Tekinerdogan
R2	Software Testing: Concepts and Operations by Rajiv Chopra
R3	Software Testing and Quality Assurance – Theory and Practice, Kshirasagar Naik, Priyadarshi Tripathy, Wiley, 2013
R4	Software Quality Engineering – Jeff Tian, Wiley India, 2015
R5	Quality Planning and Assurance Book by Herman Tang

## **Content Structure**

### **Module 1: Essential SQA: Processes and Success Factors**

Topic No.	Topic Title	Reference
1.1	Definition and importance of software quality assurance	T1 Chapter 1
1.2	Distinction between Quality Assurance and Quality Control	Lecture Notes
1.3	Success Factors in Quality Assurance	T1 Chapter 1 & T2 Chapter 1
1.4	Cost of Quality and Quality Culture	T1 Chapter 2
1.5	Role of SQA in software development life cycle	Lecture Notes

### **Module 2: Standardizing SQA: Quality Models and Management**

Topic No.	Topic Title	Reference
2.1	Software Quality Models	T1 Chapter 3, R1 Chapter 2
2.2	Specifying Quality Requirements and Plan	T1 Chapter 3
2.3	Requirement Traceability During Software Lifecycle	T1 Chapter 3
2.4	Standards for Quality Management	T1 Chapter 4
2.5	Frameworks (ITIL, ISO, CMMi)	T1 Chapter 4

### **Module 3: Fundamentals of SQA: Software Quality Attributes**

Topic No.	Topic Title	Reference
3.1	Software Requirements into Software Quality Factors	T2 Chapter 3
3.2	Understanding quality attributes <ul style="list-style-type: none"><li>• Reliability</li><li>• Usability</li><li>• Maintainability</li><li>• Other quality attributes</li></ul>	T2 Chapter 3, R1 Chapter 2
3.3	Alternative models of Software Quality Factors	T2 Chapter 3

### **Module 4: Deep driving SQA: Software Testing Techniques**

Topic No.	Topic Title	Reference
4.1	Software Testing Fundamentals	T2 Chapter 9, R2 Chapter 1
4.2	Software Verification and Validation	R2 Chapter 2
4.3	Test design techniques (black-box testing, white-box testing, boundary value analysis, equivalence partitioning, etc.)	R2 Chapter 3 & 4
4.4	Test levels and types (unit testing, integration testing, system testing, etc.)	R2 Chapter 7

**Module 5: Mastering SQA: Test Execution and Automated Testing**

Topic No.	Topic Title	Reference
5.1	Test Execution Process	T2 Chapter 10
5.2	Test Case Design	T2 Chapter 10
5.3	Automated testing	T2 Chapter 10, R2 Chapter 9
5.4	Alpha and Beta site testing programs	T2 Chapter 10
5.5	Regression Testing Strategies	R2 Chapter 6, R2 Chapter 12
5.6	Case Study: Exploring Automated Source Code Analyzers and Software Composition Analysis Tools	Lecture Notes

**Module 6: Effective SQA: Quality Audits and Project Assessments**

Topic No.	Topic Title	Reference
6.1	Personal Review, Inspection Review and Project Assessments	T1 Chapter 5, T2 Chapter 8
6.2	Types of Audits (Internal, Third Party)	T1 Chapter 6
6.3	Project Assessment and Control Process	T1 Chapter 6, T2 Chapter 8
6.4	Corrective Actions	T1 Chapter 8

**Module 7: Comprehensive SQA: Effective Test Management and Planning**

Topic No.	Topic Title	Reference
7.1	Test Organization and Team Management	T1 Chapter 5
7.2	Test Estimation and Scheduling	R1 Chapter 7
7.3	Test Data Management	Lecture Notes
7.4	Configuration Management and Change Control	T1 Chapter 8, T1 Chapter 5
7.5	Case Study: Develop a test plan and design test cases for a given software application	Lecture Notes

**Module 8: Enhancing SQA: Process Improvement and Metrics**

Topic No.	Topic Title	Reference
8.1	Introduction to Test Process Improvement	T1 Chapter 9
8.2	Capability Maturity Model Integration (CMMI) for Testing	T1 Chapter 10
8.3	Six Sigma in Software Testing	Lecture Notes
8.4	Test Metrics for Process Improvement	T2 Chapter 21

**Module 9: Optimizing SQA: Agile Testing and DevOps Integration**

Topic No.	Topic Title	Reference
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9.1	Introduction to Agile Methodology and Testing	T1 Chapter 4
9.2	Agile Test Planning and Execution	T1 Chapter 5
9.3	Continuous Testing in DevOps	Lecture Notes
9.4	Test Environment and Test Data Management in DevOps	Lecture Notes

#### **Module 10: Excelling SQA: Best Practices and Case Studies**

Topic No.	Topic Title	Reference
10.1	Best Practices for SQA implementation	T1 Chapter 4, Lecture Notes
10.2	Quality assurance in different development methodologies (Waterfall, Agile, etc.)	T2 Chapter 7
10.3	Building a quality culture in organizations	R1 Chapter 7
10.4	Case studies of successful SQA implementations	Lecture Notes
10.5	Lessons learned from successful software quality assurance projects	Lecture Notes

#### **Module 11: Shaping SQA: An Outlook for the Future**

Topic No.	Topic Title	Reference
11.1	Emerging technologies and their impact on SQA	Lecture Notes
11.2	Artificial intelligence and machine learning in quality assurance	Lecture Notes
11.3	Blockchain and quality assurance	Lecture Notes
11.4	Future directions and career opportunities in SQA	Lecture Notes

#### **Learning Outcomes:**

No	Learning Outcomes	Objectives
LO1	Advanced knowledge of Software Quality Assurance principles and methodologies	By the end of the course, participants should have an in-depth understanding of the advanced principles, concepts, and methodologies of Software Quality Assurance. They should be well-versed in topics like quality models, process improvement frameworks (e.g., CMMI, Six Sigma), risk management, and the application of SQA in different software development models (e.g., Agile, DevOps).
LO2	Master testing techniques and tools for comprehensive software testing.	Upon completing the course, participants should have a solid knowledge of various testing techniques, such as unit testing, integration testing, system testing, and acceptance testing. They should also be proficient in using popular testing tools and frameworks to create, execute, and analyse test cases effectively, ensuring comprehensive test coverage and defect detection.
LO3	Proficiency in designing and implementing robust quality assurance	Upon completing the course, participants should be capable of developing comprehensive and effective quality assurance strategies tailored to specific software projects. They should be skilled in devising test plans, defining test

	strategies	cases, and establishing quality metrics to measure the performance and reliability of software applications across different domains and industries.
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## Part B: Contact Session Plan

<b>Academic Term</b>	First Semester 2024-2025
<b>Course Title</b>	Software Quality Assurance and Testing
<b>Course No</b>	SE ZG501
<b>Lead Instructor</b>	Rajesh S

### Teaching Methodology (*Online Session Mode*)

The pedagogy for this course is centred around online contact sessions, which consist of 2-hour lecture sessions. In addition to the delivery of lessons on the topics, these contact sessions will also be enriched with discussions on organization-specific practices and case studies from experienced QA managers in the Indian IT industry.

### Course Delivery

- There are 16 Contact Sessions (of 2 hours each)—8 before mid-semester and 8 post-mid-semester over a period of 16 weeks
- The 8<sup>th</sup> & 16<sup>th</sup> Contact Sessions are planned for review of topics pre-mid-semester and pre-comprehensive examinations.

### Course Contents

Contact Session	List of Topic Title
1	Module 1: Essential SQA: Processes and Success Factors
2	Module 2: Standardising SQA: Quality Models and Management
3-4	Module 3: Fundamentals of SQA: Software Quality Attributes
5	Module 4: Deep driving SQA: Software Testing Techniques
6-7	Module 5: Mastering SQA: Test Execution and Automated Testing
8	<b>Review of Contact Session Topics (1 to 7) for Mid-Sem Examination</b>
9	Module 6: Effective SQA: Quality Audits and Project Assessments
10-11	Module 7: Comprehensive SQA: Effective Test Management and Planning
12	Module 8: Enhancing SQA: Process Improvement and Metrics
13	Module 9: Optimizing SQA: Agile Testing and DevOps Integration
14	Module 10: Excelling SQA: Best Practices and Case Studies
15	Module 11: Shaping SQA: An Outlook for the Future
16	<b>Review of All Topics for Comprehensive Examination</b>

## Assignments

Each participant or Group of participants will be given an assignment on a topic that was discussed in class. The assignment topics will be based on practical problems experienced or part of work items or tools used by collaborating organizations.

- Assignments will be take-home and deadline-driven, typically lasting 2 weeks. Participants are expected to spend at least 16 hours on the study, research, discussion, and preparation of the report and presentation.
- As part of the deliverables, participants will prepare a report and/or make a short presentation in class.

## Experiential Learning Components

No	Topic	Objectives	Hands-On-Exercises
1	SQA Planning and Design	Learn how to create a comprehensive test plan and design effective test cases.	Develop a test plan and design test cases for a given software application.
2	Automation Frameworks	Introduction to automation tools and frameworks	Automate test cases using a popular test automation tool.
3	Usability Testing	Understand the importance of user experience and usability in software.	Conduct usability testing on a software interface and provide recommendations for improvement.
4	Continuous Integration and Continuous Testing	Explore the concepts of continuous integration and continuous testing in SQA	Demonstration of CI/CD pipeline and automate the testing process for a software application.

## Evaluation Scheme:

**Legend:** EC = Evaluation Component; AN = After Noon Session; FN = Fore Noon Session

Evaluation Component	Name (Quiz, Lab, Project, Mid-term exam, End semester exam, etc.)	Type (Open book, Closed book, Online, etc.)	Weight	Duration	Day, Date, Session, Time
EC - 1	Quiz-I/ Assignment-I	Online	7.5%		September 1-10, 2024
	Quiz-II	Online	7.5%		October 10-20, 2024
	Quiz-III/ Assignment-II	Online	15%		November 1-10,

					2024
EC - 2	Mid-sem	Closed book	30%	2 hours	Friday, 20/09/2024 (AN)
EC - 3	Comprehensive	Open book	40%	2 ½ hours	Friday, 29/11/2024 (AN)

**Note: If Assignment kindly remove Quiz-I, II, III**

Syllabus for Mid-Semester Test (Closed Book): Topics in Contact Hours: 1 to 8

Syllabus for Comprehensive Exam (Open Book): All topics

Important links and information:

Elearn portal: <https://elearn.bits-pilani.ac.in>

Students are expected to visit the Elearn portal on a regular basis and stay up to date with the latest announcements and deadlines.

Contact sessions: Students should attend the online lectures as per the schedule provided on the Elearn portal.

Evaluation Guidelines:

1. EC-1 consists of either two Assignments or three Quizzes. Students will attempt them through the course pages on the Elearn portal. Announcements will be made on the portal, in a timely manner.
2. For Closed Book tests: No books or reference material of any kind will be permitted.
3. For Open Book exams: Use of books and any printed / written reference material (filed or bound) is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.
4. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam which will be made available on the Elearn portal. The Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.

It shall be the responsibility of the individual student to be regular in maintaining the self-study schedule as given in the course handout, attend the online lectures, and take all the prescribed evaluation components such as Assignment/Quiz, Mid-Semester Test and Comprehensive Exam according to the evaluation scheme provided in the handout.

**Instructor-in-charge**