

**Birla Institute of Technology & Science, Pilani**  
**Work Integrated Learning Programmes Division**  
**Second Semester 2024-2025**  
**Digital Learning Handout**

**Part A: Content Design**

Course Title	Software Quality Assurance and Testing
Course No(s)	SE_ZG501
Credit Units	4
Credit Model	14-2-2 (14 Hours of Class-room Instruction + 2 Hours of Case-studies/Tutorials/ + 2 Hours of Student Preparation)
Instructors	Dr.N.Jayakanthan
Version No:	1
Date:	16.01.2025

**Course Description:**

**Commented [1]:** Course description should be as per Senate approved document

**Course Objectives**

No	Course Objective
<b>C01</b>	Develop a strong foundation in software quality assurance principles, methodologies, and best practices to ensure the delivery of reliable and high-quality software products.
<b>C02</b>	Demonstrate proficiency in utilizing various software testing techniques, verification methods, and validation tools to identify and resolve defects effectively.
<b>C03</b>	Gain expertise in designing and implementing test plans, test cases, and test strategies to ensure thorough and systematic evaluation of software quality.
<b>C04</b>	Apply advanced quality assurance techniques, including test automation, continuous integration, and agile testing, to improve software development efficiency and effectiveness.
<b>C05</b>	Analyze and adapt quality assurance processes to align with industry standards and emerging trends, ensuring consistent delivery of top-notch software solutions.

**Text Book(s):**

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

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

<b>R1</b>	Software Quality Assurance By Ivan Mistrik, Richard M Soley, Nour Ali, John Grundy, Bedir Tekinerdogan
<b>R2</b>	Software Testing: Concepts and Operations by Rajiv Chopra
<b>R3</b>	Software Testing and Quality Assurance – Theory and Practice, Kshirasagar Naik, Priyadarshi Tripathy, Wiley, 2013

**Commented [2]:** With edition and year of publication

**Commented [3]:** latest edition of book



<b>R4</b>	Software Quality Engineering – Jeff Tian, Wiley India, 2015
<b>R5</b>	Quality Planning and Assurance Book by Herman Tang

**Learning Outcomes: Students will be able to**

LO1	Participants will acquire a comprehensive understanding of advanced Software Quality Assurance (SQA) principles, concepts, and methodologies, including quality models, process improvement frameworks (e.g., CMMI, Six Sigma), and risk management strategies.
LO2	Participants will gain proficiency in applying SQA across various software development models, such as Agile and DevOps, ensuring the integration of quality practices throughout the software lifecycle.
LO3	Participants will develop expertise in diverse testing techniques, including unit, integration, system, and acceptance testing, as well as hands-on experience with popular testing tools and frameworks for test creation, execution, and analysis.
LO4	Participants will be equipped to design effective quality assurance strategies tailored to specific software projects, incorporating test plans, defined test cases, and comprehensive quality metrics to assess software performance and reliability.
LO5	Participants will enhance their ability to ensure comprehensive test coverage, detect defects effectively, and contribute to the delivery of high-quality software applications across different domains and industries.

**Part B: Learning Plan**

Contact Session	List of Topic Title	Sub-Topics	Reference
1	Definition and importance of software quality assurance	Introduction, Standards, Errors Defects Failures	T1 Chapter 1
	Distinction between Quality Assurance and Quality Control	Software Quality Assurance, Quality Control	Lecture Notes
	Success Factors in Quality Assurance	Factors Foster Software quality and Factors effect software quality	T1 Chapter 1 & T2 Chapter 1
2	Cost of Quality and Quality Culture	Cost of projects, Calculations, Quality Culture Principles	T1 Chapter 2
	Quality Culture Principles	Principles for Ensuring a Quality-Driven Culture	T1 Chapter 2
	Role of SQA in software development life cycle		Lecture Notes
3	Software Quality Models	Quality Perspective McCall, IEE1601, ISO 25000	T1 Chapter 3, R1 Chapter 2
	Specifying Quality Requirements and Plan	Definition, Type of requirements, Characteristics	T1 Chapter 3



	Requirement Traceability During Software Lifecycle	Process	T1 Chapter 3
4	Standards and Frameworks for Quality Management	Standards (ISO 9001, ISO/IEC 90003, ISO/IEC/IEEE 12207, IEEE 730)	T1 Chapter 4
	Frameworks (ITIL, ISO, CMMi)	Overview of ITIL, ISO, CMMi Frameworks	T1 Chapter 4
5	Software Requirements into Software Quality Factors	Models, Product operation factors, Product Revision factors, Product Transition factors	T2 Chapter 3
	Understanding quality attributes <ul style="list-style-type: none"> <li>Reliability</li> <li>Usability</li> <li>Maintainability</li> </ul> Other 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
6	Alternative models of Software Quality Factors	Evans and Marciniak Factor Model, Deutsch and Willis Factor Model	T2 Chapter 3
	Software Testing Fundamentals	Key Characteristics, Software Testing Strategies	T2 Chapter 9, R2 Chapter 1
	Software Verification and Validation	Definition, Techniques	R2 Chapter 2
7	Test design techniques (black-box testing, white-box testing, boundary value analysis, equivalence partitioning, etc.)	black-box testing, white-box testing, boundary value analysis, equivalence partitioning	R2 Chapter 3 & 4
	Test levels and types (unit testing, integration testing, system testing, etc.)	Unit testing, Integration testing, System testing	R2 Chapter 7
	Test Execution Process	Test Methodology, Planning, Designing, Performing	T2 Chapter 10
	Test Case Design	Test Case Examples	T2 Chapter 10
8	<b>Review of Contact Session Topics (1 to 7) for Mid-Sem Examination</b>		
9	Automated testing	Automated Testing Processes, Types, Test Management	T2 Chapter 10, R2 Chapter 9
	Alpha and Beta site testing programs	Testing Methods, Advantages, Disadvantages	T2 Chapter 10





	Regression Testing Strategies	Types, Comparison of Regression Testing Techniques	R2 Chapter 6, R2 Chapter 12
	Case Study: Exploring Automated Source Code Analysers and Software Composition Analysis Tools	Case study	Lecture Notes
10	Reviews, Inspections, and Assessments	Personal Review, Inspection Review,	T1 Chapter 5, T2 Chapter 8
	Types of Audits (Internal, Third Party)	Internal Audit, Second Party Audit and Third-Party Audit	T1 Chapter 6
	Project Assessment and Control Process	Definition, Objectives and Methods	T1 Chapter 6, T2 Chapter 8
	Corrective Actions	Problem Identification and Resolution, Corrective Action (CA) Process, Report	T1 Chapter 8
11	Test Organization and Team Management	Key Components, Aspects, Best Practices	T1 Chapter 5
	Test Data Management	Key Components, Challenges, Best Practices	Lecture Notes
	Configuration Management and Change Control	Components, Tools, Challenges, Best Practices	T1 Chapter 8, T1 Chapter 5
	Case Study: Develop a test plan and design test cases for a given software application	Case Study	Lecture Notes
12	Introduction to Test Process Improvement	Goals, Steps, Benefits	T1 Chapter 9
	Capability Maturity Model Integration (CMMI) for Testing	Overview, Maturity Levels, Measurement and Analysis Process	T1 Chapter 10
13	Six Sigma in Software Testing	Introduction, Objective, Framework, Metrics, Benefits and Challenges	Lecture Notes
	Test Metrics for Process Improvement	Objectives, Classification	T2 Chapter 21
	Introduction to Agile Methodology and Testing	Key features, principles, Frameworks, Types and Tools	T1 Chapter 4
14	Continuous Testing in DevOps	Introduction, Pipeline, Life Cycle, Benefits, Continuous Testing, Tools	Lecture Notes
	Best Practices for SQA implementation	List of Best Practises	T1 Chapter 4, Lecture Notes





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	Lessons learned from successful software quality assurance projects	Key Lessons	Lecture Notes
15	Emerging technologies and their impact on SQA	Artificial Intelligence (AI) and Machine Learning (ML), Cloud Computing, Internet of Things (IoT), Blockchain Technology etc.,	Lecture Notes
	Artificial intelligence and machine learning in quality assurance	Applications of AI/ML in Quality Assurance, . Anomaly Detection, Test Case Prioritization, Predictive Analytics, Automation and Robotics. Virtual and Augmented Reality	Lecture Notes
	Blockchain and quality assurance	Applications of Blockchain in Quality Assurance, Automated QA Workflows with Smart Contracts, Compliance and Certification, Secure Collaboration Across Teams, Real-Time Monitoring and Reporting etc.,	Lecture Notes
16	<b>Review of All Topics for Comprehensive Examination</b>		

#### 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.



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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.
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**Objective of Experiential Learning Component:**

1. SQA Planning and Design: Develop skills to create a test plan and design test cases for a software application.
2. Automation Frameworks: Gain practical experience in automating test cases using popular tools.
3. Usability Testing: Learn to conduct usability testing and provide recommendations for user experience improvement.
4. Continuous Integration and Continuous Testing: Understand and implement CI/CD pipelines with automated testing.

**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%		February 17-27, 2025
	Quiz-II	Online	7.5%		April 1-10, 2025
	Quiz-III/ Assignment-II	Online	15%		May 1-10, 2025
EC - 2	Mid-Semester Test	Closed Book	30%	2 hours	21/03/2025 (AN)
EC - 3	Comprehensive Exam	Open Book	40%	2 ½ Hours	23/05/2025 (AN)

EC1\* (20% - 30%): Quiz (optional): 5-10 %, Lab Assignment/Assignment: 20% - 30%



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Syllabus for Mid-Semester Test (Closed Book): Topics in Contact session: 1 to 8  
Syllabus for Comprehensive Exam (Open Book): All topics

**Important Links and Information:**

**eLearn Portal:** <https://elearn.bits-pilani.ac.in>

Students must visit the eLearn portal regularly and stay updated 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: "open book" means text/ reference books (publisher copy only) and does not include any other learning material. No other learning material will be permitted during the open book examinations. For Detailed Guidelines refer to the attached document. [EC3 Guidelines](#)
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 Assignments/Quizzes, Mid-Semester Tests and Comprehensive Exams according to the evaluation scheme provided in the handout.

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