GUJARAT TECHNOLOGICAL UNIVERSITY

BE-7 SEMESTER – OLD PAPER – S22 TO S26 – ANSWER BANK

Subject Name & Code: Quality and Reliability Engineering - 3171929

Chapter 1: Introduction to Quality

Repeated Questions:

1. Definitions and Dimensions of Quality:

- **Q.** Explain any three dimensions of Quality. **(SUMMER 2023, 3 Marks; WINTER 2023, 4 Marks)**

Answer:

1. Performance:

The primary operating characteristics of a product.

- **Example:** Speed of a motorcycle, resolution of a camera.

2. Reliability:

Probability that a product will perform without failure for a specified period.

Measures consistency of performance over time.

3. Aesthetics:

- **Subjective sensory characteristics:** appearance, feel, sound, taste, smell.

How a product looks, feels, sounds to the customer.

- **Q.** Give various definitions of Quality. **(WINTER 2022, 4 Marks; SUMMER 2025, 4 Marks)**

Answer:

1. Joseph Juran:

"Quality is fitness for use." Focuses on meeting customer needs and satisfaction.

2. W. Edwards Deming:

"Quality is a predictable degree of uniformity and dependability at low cost and suited to the market."

3. Philip Crosby:

"Quality is conformance to requirements." Emphasis on zero defects.

4. ISO 9000 Definition:

"Degree to which a set of inherent characteristics fulfills requirements."

5. Armand Feigenbaum:

"Quality is the total composite product and service characteristics that meet customer expectations."

- **Q.** Define: (1) Quality (2) TQM (3) Poka yoke. **(WINTER 2022, 3 Marks; WINTER 2025, 3 Marks)**

Answer:

1. Quality:

"Quality is the degree to which a product or service meets or exceeds customer expectations consistently."

2. TQM (Total Quality Management):

"A management approach focused on long-term success through customer satisfaction by involving all members of an organization in improving processes, products, and services."

3. Poka-yoke:

"A mistake-proofing technique that prevents human errors from occurring or detects them immediately, ensuring defects cannot pass through the process."

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2. Quality Gurus:

- **Q.** List/Name five Quality Gurus and explain the contribution of any two. **(WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks)**

Answer:

Five Quality Gurus:

#	Guru	Key Contribution
1	W. Edwards Deming	14 Points for Management; PDCA Cycle
2	Joseph Juran	Quality Trilogy (Planning, Control, Improvement); Pareto Principle
3	Philip Crosby	Zero Defects; Quality is Free concept
4	Armand Feigenbaum	Total Quality Control (TQC)
5	Kaoru Ishikawa	Cause-and-Effect Diagram; Quality Circles

Contribution of W. Edwards Deming:

Developed the 14 Points of Management emphasizing continuous improvement.

Introduced the PDCA (Plan-Do-Check-Act) Cycle for process improvement.

Stressed that 85% of quality problems are management-controlled, not worker-related.

Contribution of Joseph Juran:

- **Developed the Quality Trilogy:** Quality Planning, Quality Control, Quality Improvement.
- **Introduced the Pareto Principle (80/20 rule) to quality:** 80% of problems arise from 20% of causes.

  Emphasized management involvement and setting quality goals.

- **Q.** How Juran, Deming and Crosby define Quality? **(WINTER 2023, 3 Marks; SUMMER 2026, 3 Marks – "Define Quality as per view of Dr. Juran and Dr. Philip Crosby.")**

Answer:

1. Dr. Joseph Juran:

"Quality is fitness for use" – meets customer needs and usage requirements.

2. Dr. W. Edwards Deming:

"Quality is a predictable degree of uniformity and dependability at low cost and suited to the market."

3. Dr. Philip Crosby:

"Quality is conformance to requirements" – exactly meeting the stated specifications with zero defects.

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3. Inspection, Quality Control and Quality as a Strategy:

- **Q.** Differentiate between Inspection and Quality Control. **(SUMMER 2023, 7 Marks; WINTER 2024, 3 Marks)**

Answer:

Aspect	Inspection	Quality Control
Definition	Process of examining and measuring products against standards	System of activities to ensure products meet quality requirements
Scope	Product-focused (identifies defects)	Process-focused (prevents defects)
Timing	After production (post-process)	During and before production (in-process)
Approach	Reactive (detects defects)	Proactive (prevents defects)
Responsibility	Inspection department/QC inspector	All production staff and management
Methods	Visual examination, gauging, testing	SPC, control charts, process capability
Output	Accept/Reject decision	Continuous process improvement
Cost Impact	High (scrap, rework, inspection costs)	Lower (prevents defects at source)

Detailed Explanation:

Inspection:

Involves checking products at various stages of production against specified standards.

- **Activities include:** receiving inspection, in-process inspection, final inspection.

Does not control the process; only separates good products from bad ones.

Quality Control:

Involves monitoring processes using statistical techniques to ensure consistent quality.

Uses tools like Control Charts, Histograms, Pareto Analysis.

Acts on the process to prevent defects, not just detect them.

- **Key Difference:** Inspection identifies defects after they occur; Quality Control prevents defects from occurring by controlling the process.

- **Q.** Justify "Quality as a winning strategy" / "Quality products make a significant impact on revenues". **(SUMMER 2022, 3 Marks; WINTER 2024, 4 Marks)**

Answer:

Quality as a Winning Strategy:

Higher Customer Satisfaction:

Quality products meet/exceed expectations → higher customer satisfaction → customer loyalty and repeat purchases.

Premium Pricing:

Quality products command higher prices in the market, directly increasing revenue per unit.

Reduced Costs:

Lower rework, scrap, and warranty costs → improved profit margins.

Market Share Growth:

Reputation for quality attracts new customers and expands market share.

Competitive Advantage:

Quality differentiates products in competitive markets → sustainable advantage.

Customer Retention:

Satisfied customers return; retaining customers costs less than acquiring new ones.

- **Conclusion:** Quality is not just a cost; it is an investment that directly increases revenues through customer loyalty, premium pricing, and expanded market share.

Other Important Questions:

1. Quality Control and Quality Assurance:

- **Q.** Differentiate between Quality Control and Quality Assurance. **(SUMMER 2022, 4 Marks)**

Answer:

Aspect	Quality Control (QC)	Quality Assurance (QA)
Definition	Activities to verify product quality against standards	Planned activities to ensure quality is built into the process
Focus	Detection of defects	Prevention of defects
Orientation	Product-oriented	Process-oriented
Approach	Find faults and fix them	Build quality into the process
Responsibility	QC/Inspection department	All departments, management-led
Activity Type	Testing, inspection, SPC	Audits, training, documentation, QMS

- **Quality Control:** Involves monitoring and measuring products to verify conformance to specifications. It is reactive in nature.
- **Quality Assurance:** Involves creating systems and processes that ensure quality is achieved consistently. It is proactive and comprehensive.

- **Q.** Enlist the various phases of Quality Revolution and discuss inspection, quality control and quality assurance. **(SUMMER 2025, 7 Marks OR)**

Answer:

Phases of Quality Revolution:

Inspection Phase (1900s-1920s):

Focus on detecting defects in finished products.

Reactive approach; no process control.

Quality Control Phase (1930s-1950s):

Statistical Quality Control (SQC) introduced by Shewhart.

Use of control charts and sampling techniques.

Quality Assurance Phase (1960s-1970s):

Focus shifted from detection to prevention.

Quality built into design and manufacturing processes.

Total Quality Management Phase (1980s-Present):

Organization-wide quality commitment.

Customer focus, continuous improvement, employee involvement.

Inspection:

- **Definition:** "Inspection is the process of examining products to determine whether they conform to specifications."

Focuses on identifying defects after production.

Does not improve the process; only separates conforming from non-conforming products.

Quality Control:

- **Definition:** "Quality Control is the use of statistical methods and process monitoring to ensure product quality."

Uses SPC, control charts, sampling plans.

Focuses on controlling the process to prevent defects.

Quality Assurance:

- **Definition:** "Quality Assurance is the systematic set of activities designed to ensure that quality requirements are met."

  Includes planning, training, audits, documentation.

  Proactive approach; builds quality into every stage.

- **Q.** State objectives of quality control. **(WINTER 2025, 3 Marks)**

Answer:

Objectives of Quality Control:

To ensure products conform to specifications and standards consistently.

To detect and prevent defects at the earliest stage of production.

To minimize waste, scrap, and rework costs by controlling processes.

To improve process efficiency through statistical monitoring and feedback.

To satisfy customer requirements by delivering defect-free products.

- **Q.** Write short notes on Total quality control. **(SUMMER 2026, 7 Marks)**

Answer:

Definition:

Total Quality Control (TQC) is a comprehensive approach to quality management where quality control activities are integrated across all departments and functions, involving every employee.

Key Features:

Organization-Wide Involvement:

Quality is a responsibility of all departments – R&D, purchasing, production, sales, service.

Not limited to a single QC department.

Customer Focus:

Quality means meeting internal and external customer requirements.

Every employee has a customer (internal or external).

Continuous Improvement:

Systematic approach to improve processes and products continuously.

Prevention Over Detection:

Focus on preventing defects rather than detecting them after occurrence.

Quality is built into the process.

Statistical Approach:

Uses statistical methods for process control and analysis.

Employee Training and Education:

Continuous training in quality principles and problem-solving techniques.

Contributions of Armand Feigenbaum:

Introduced the concept of TQC in 1956.

Defined TQC as a system for integrating quality development, quality maintenance, and quality improvement efforts across all functions.

Benefits:

Reduced defects and rework costs.

Improved customer satisfaction.

Higher productivity and profitability.

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2. TQM:

- **Q.** What do you mean by TQM? Also discuss principles of TQM. **(WINTER 2024, 7 Marks)**

Answer:

Definition:

Total Quality Management (TQM) is a management philosophy that seeks to integrate all organizational functions to focus on meeting customer needs and organizational objectives by involving all employees in continuous improvement.

TQM Framework:

Element	Description
Total	All departments, processes, and employees involved
Quality	Conformance to requirements; fitness for use
Management	Leadership commitment; systematic approach

Principles of TQM:

Customer Focus:

Customer satisfaction is the ultimate goal.

Understanding and meeting customer requirements is essential.

Internal customers (employees) and external customers (buyers).

Leadership:

Top management must lead by example.

Establish clear vision, mission, and quality policy.

Provide resources and remove barriers.

Employee Involvement:

All employees participate in quality improvement.

Empowerment, teamwork, and training are emphasized.

Ideas and suggestions from employees are valued.

Process-Centered Approach:

Understand and improve processes to achieve quality.

Process is the focus, not individual tasks.

Use statistical methods for process control.

Integrated System:

Quality management is integrated into all departments.

Use of quality systems and standards (ISO 9000).

Strategic and Systematic Approach:

Quality is included in organizational strategy.

Systematic planning and implementation of quality goals.

Continuous Improvement:

Constant quest for improvement using PDCA cycle.

Benchmarking to compare with best practices.

Fact-Based Decision Making:

Decisions based on data and statistical analysis.

Use of quality tools and techniques.

Communication:

Effective communication at all levels.

Share information, feedback, and results.

Results-Oriented:

Focus on measurable outcomes.

Reduce costs, improve quality, increase customer satisfaction.

Benefits of TQM:

Improved product quality.

Higher customer satisfaction.

Reduced defects and waste.

Better employee morale.

Increased profitability.
