

ME573	QUALITY SCIENCE AND ENGINEERING	L-T-P-CH-CR: 3-0-0-3-3	Prerequisites: None
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Course Objectives:

- i. To introduce basic concepts and practices of quality
- ii. To understand statistical methods and tools employed for assurance of quality in products, processes and systems in an industrial environment (manufacturing and service organizations)
- iii. To acquaint with concepts of design for reliability, robust design and Taguchi method for quality improvement.
- iv. To provide knowledge on productive maintenance.

Course Contents:

Part I:

Principle and practices of Quality engineering: Basic definition of quality, new and old culture, dimensions of quality, Deming's philosophy.

Quality of leadership: Leadership concept and characteristics, quality council, core value and concept, vision and mission statement, strategic planning.

Customer satisfaction: Introduction, customer supplier chain, feedback, translating needs into requirements, customer retention.

Involvement of employee: Maslow's Hierarchy of Needs, Herzberg's Two Factor Theory, Employee wants, Empowerment, characteristics of a successful team, recognition and reward, benefits from employee involvement.

Continuous process improvement: Introduction, Input/ out process model, Juran Trilogy, Plan-Do-Study-Act (PDSA) cycle, Problem solving method.

Supplier Partnership: Introduction, Supplier selection, principle of customer/supplier relations, supplier selection, rating and certification, Relationship development.

Performance evaluation: Basic concepts, Quality cost, Cost categories, Optimum cost, Quality cost analysis, Reporting, Quality improvement strategy, Malcolm Baldrige National Quality Award.

Part II:

Statistical process control (SPC): Histogram, Pareto Analysis, Process flow diagram, Cause and effect diagram, check sheet, statistical fundamental, X and R chart, Chart for attributes, scatter diagram.

ISO9000& 14000: Introduction, ISO 9000 series standards, elements of ISO/QS 9000, steps to implement quality systems, ISO 14000 series standards, concepts and requirement of ISO 14001, EMS benefits.

Benchmarking: Definition, reasons for benchmarking, what to benchmark, planning, studying others, Pitfalls and Criticisms of benchmarking.

Quality function deployment: Introduction, benefits of QFD, the voice of the customer, affinity diagram, Building of a house of quality, QFD process.

Taguchi's quality engineering: Taguchi's loss function, step and quadratic function, signal- to- noise (S/N) ratio, Orthogonal Array.

Liability of products: Introduction, product safety law, product liability law, proof and expert witness, financial loss, future of product liability.

Failure mode and effect analysis (FMEA): Introduction, Reliability and its requirement, failure rate, intent of FMEA, FMEA documentation, Stages of FMEA, Design of FMEA document.

Management tools: Introduction, forced field analysis, interrelationship digraph, Tree diagram, matrix diagram, Process Decision Program Chart (PDPC), activity network diagram.

Total productive maintenance: Introduction, Learning the new philosophy, improvement needs, Autonomous work group.

Time Plan:

SN	Topic	Content details	L	T	P	Total
1	Principle and practices of TQM	Basic definition of quality, new and old culture, dimensions of quality, Deming's philosophy.	1	0	0	1
2	Quality of leadership	Leadership concept and characteristics , quality council, core value and concept, vision and mission statement, strategic planning	2	0	0	2
3	Customer satisfaction	Introduction, customer supplier chain, feedback, translating needs into requirements, customer retention	2	0	0	2
4	Involvement of employee	Maslow's Hierarchy of Needs, Herzberg's Two Factor Theory, Employee wants, Empowerment, characteristics of a successful team, recognition and reward, benefits from employee involvement	2	0	0	2
5	Continuous process improvement	Introduction, Input/ out process model, Juran Trilogy, Plan-Do-Study-Act (PDSA) cycle, Problem solving method.	2	0	0	2
6	Supplier Partnership	Introduction, Supplier selection, principle of customer/supplier relations, supplier selection, rating and certification, Relationship development	2	0	0	2
7	Performance Evaluation	Basic concepts, Quality cost, Cost catagories, Optimum cost, Quality cost analysis, Reporting, Quality improvement strategy, Malcolm Baldrige National Qulaity Award.	3	0	0	3
8	Statistical process control (SPC)	Histogram, Pareto Analysis, Process flow diagram, Cause and effect diagram, check sheet, statistical fundamental, X and R chart, Chart for attributes , scatter diagram	3	0	0	3
9	ISO9000& 14000	Introduction, ISO 9000 series standards, elements of ISO/QS 9000, steps to implement a quality systems, ISO 14000 series standards, concepts and requirement of ISO 14001, EMS benefits	3	0	0	3
10	Benchmarking	Definition, reasons for benchmarking, what to benchmark, planning, studying others, Pitfalls and Criticisms of benchmarking	3	0	0	3
11	Quality function deployment	Introduction, benefits of QFD, the voice of the customer, affinity diagram, Building of a house of quality, QFD process	2	0	0	2

12	Product and system reliability	Definition, stages of failure (bath tub curve), probability distribution function, probability density function, exponential failure rate, hazard rate, reliability function derivation, Weibull distribution, system reliability-series, parallel and combination of series and parallel arrangement, improvement of reliability.	3	0	0	3
13	Taguchi's quality engineering	Taguchi's loss function, step and quadratic function, signal-to-noise (S/N) ratio, Orthogonal Array	3	0	0	3
14	Liability of products	Introduction, product safety law, product liability law, proof and expert witness, financial loss, future of product liability	2	0	0	2
15	Failure mode and effect analysis (FMEA)	Introduction, Reliability and its requirement, failure rate, intent of FMEA, FMEA documentation, Stages of FMEA, Design of FMEA document,	2	0	0	2
16	Management tools	Introduction, forced field analysis, interrelationship digraph, Tree diagram, matrix diagram, Process Decision Program Chart (PDPC), activity network diagram.	3	0	0	3
17	Total productive maintenance	Introduction, Learning the new philosophy, improvement needs, Autonomous work group	1	0	0	1
	Total		39	0	0	39

Textbooks

1. Krishnamoorthi K.S., Krishnamoorthi V.Ram. *Quality Engineering*. CRC press, Taylor and Francis.
2. Besterfield Dale H., Besterfield-Michna C, Besterfield G H, and Besterfield-Sacre M. *Total Quality Management*. Pearson Education Asia, 2002.
3. Besterfield Dale H., *Quality Control*. Prentice Hall Career & Technology Eaglewood Cliff, NJ 07632.
4. Hoang Pham. *Recent Advances in Reliability and Quality Engineering*. World Scientific, 2001.

Reference Books

1. Pyzdek Thomas and Berger Roger W. *Quality Engineering Handbook*. Tata McGraw Hill, 1996.
2. Khanna O.P. and Sarup A. *Industrial Engineering and management: with an appendix introducing ISO 9000 Quality systems*. Dhanpat Rai Publications, 2011.

Evaluation Plan

Test No.	Marks	Exam Type	Duration (minutes)	To be completed within
Sessional Test I	10	Assignments/ written	-	18.02.2025
Mid-Semester examination)	30	Written	90	29.03.2025
Sessional Test II	10	Quiz/Seminar/Case study	-	30.04.2025

End-Semester Examination	50	Written	120	31.05.2024
Total Marks	100			

All the examinations/tests will be held as per the Tezpur University notified Academic Calendar.

Pedagogy

Teaching-learning methods to be used:

- Lecture and Discussion
- Seminars and presentation
- Case studies/Problem solving sessions
- Assignments
- Class Tests/Quiz

Course Outcomes:

After successful completion of the course, the students would be able to

- CO1. Understand quality, its control and assurance
- CO2. Apply statistical tools to measure process capability and improve process
- CO3. Identify quality issues
- CO4. Use problem solving techniques to analyze quality issues