

ME573	QUALITY SCIENCE AND ENGINEERING	L-T-P-CH-CR: 3-0-0-3-3	Prerequisites: None
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Course Instructor: Dr Barnali Chowdhury

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