



JAIPUR ENGINEERING COLLEGE
AND RESEARCH CENTRE

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

JECRC Campus, Shri Ram ki Nangal, Via-Vatika, Tonk Road, Jaipur

Department of Mechanical Engineering

Name of Subject: Quality Management

Subject Code: 6ME4-05

Year: 4th Year, 6th Semester



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Department of Mechanical Engineering

VISION AND MISSION OF THE INSTITUTE

VISION OF JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

To become a renowned center of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

MISSION OF JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

M1: Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.

M2: Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide platform to gain knowledge and solutions.

M3: Offer opportunities for interaction between academia and industry.

M4: Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

VISION AND MISSION OF THE DEPARTMENT

VISION OF DEPARTMENT OF MECHANICAL ENGINEERING

The Mechanical Engineering Department strives to be recognized globally for outcome based technical knowledge and to produce quality human resource, who can manage the advance technologies and contribute to society.

MISSION OF DEPARTMENT OF MECHANICAL ENGINEERING

M1: To impart quality technical knowledge to the learners to make them globally competitive mechanical engineers.

M2: To provide the learners ethical guidelines along with excellent academic environment for a long productive career.

M3: To promote industry-institute relationship.



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Department of Mechanical Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To equip graduates with a strong foundation in engineering sciences, with an emphasis on mechanical engineering principles, enabling them to analyze, design, and solve real-world engineering challenges.

PEO2: To prepare graduates with sound scientific and engineering fundamentals to innovate and deliver effective solutions addressing practical challenges in mechanical engineering.

PEO3: To inculcate in graduates a professional and ethical attitude, effective communication and teamwork skills, a multidisciplinary approach, entrepreneurial mindset, and the ability to connect engineering solutions with societal and environmental concerns.

PEO4: To provide students with an academic environment that fosters excellence, leadership, adherence to ethical standards, and encourages self-motivated lifelong learning essential for a successful professional career in mechanical.

PEO5: To prepare students to excel in industry and higher education by providing quality education grounded in strong technical knowledge and high moral values.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Graduates will be able to design, analyze, and fabricate electric and hybrid vehicles using modern engineering tools and sustainable practices.

PSO2: Graduates will be able to apply design principles and computational techniques, including programming and data structures, to analyze and solve mechanical engineering problems.



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PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)



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SYLLABUS

6ME4-05: QUALITY MANAGEMENT

Credit: 3
3L+0T+0P

Max.Marks:100(IA: 30, ETE: 70)

End Term Exam: 3 Hours

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	The meaning of Quality and quality improvement dimensions of quality, history of quality methodology, quality control, Quality of design and quality of conformance, Quality policy and objectives, Economics of quality.	5
	Modeling process quality: Describing variation, frequency distribution, continuous and discrete, probability distributions, pattern of variation, Inferences about process quality: sampling distributions and estimation of process parameters. Analysis of variance.	4
3	Statistical Quality Control: Concept of SQC, Chance and assignable causes of variation, statistical basis of control chart, basic principles, and choice of control limits, sample size and sampling frequency, analysis of patterns on control charts. The magnificent seven.	4
	Control chart for variables, X-bar and R charts, X-bar and S charts, and control chart for individual measurement. Application of variable control charts.	4
4	Control chart for attributes: control chart for fraction non conforming P-chart, np-chart, c-chart and u-chart. Demerit systems, choice between attribute and variable control chart. SPC for short production runs. Process capability analysis using histogram and probability plot, capability ratios and concept of six sigma.	7
5	Quality Assurance: Concept, advantages, field complaints, quality rating, quality audit.	2
	Acceptance Sampling: Fundamental concepts in acceptance sampling, operating characteristics curve. Acceptance sampling plans, single, double and multiple sampling plans, LTPD, AOQL, AOQ.	4
	Introduction to Quality systems like ISO 9000 and ISO 14000.	2
6	Reliability and Life Testing-Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations. Introduction to Availability and Maintainability.	4
	Introduction to Taguchi Method of Design of Experiments, Quality loss function.	4
	TOTAL	41



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COURSE OUTCOMES (COs)

Subject: Quality Management

Code: 6ME4-05

CO1: Understand the fundamental concepts, principles, and importance of quality management in engineering systems.

CO2: Analyze quality tools, techniques, and statistical methods used for process improvement.

CO3: Apply Total Quality Management (TQM), Six Sigma, and ISO standards in organizational practices.

CO4: Evaluate quality control procedures, audits, and performance metrics for manufacturing and services.

CO5: Investigate failure analysis, reliability, and continuous improvement methodologies.

CO6: Develop quality improvement strategies to enhance organizational efficiency and competitiveness.

CO-PO/PSO MAPPING

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	2	1	2	1	2	1	2	2	2
CO2	3	3	2	3	3	1	1	1	2	1	3	3	3
CO3	3	3	3	3	3	1	1	2	3	2	3	3	3
CO4	3	3	3	3	3	1	1	2	3	2	3	3	3
CO5	3	3	3	3	3	2	2	2	3	2	3	3	3
CO6	3	3	3	3	3	2	2	3	3	3	3	3	3



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COURSE PLAN

Name of the Course: **Quality Management**

Code of the course: **6ME4-05**

Name of Faculty: **Dayal S. Rathore**

Course Outcome

CO1: Understand the fundamental concepts, principles, and importance of quality management in engineering systems.

CO2: Analyze quality tools, techniques, and statistical methods used for process improvement.

CO3: Apply Total Quality Management (TQM), Six Sigma, and ISO standards in organizational practices.

CO4: Evaluate quality control procedures, audits, and performance metrics for manufacturing and services.

CO5: Investigate failure analysis, reliability, and continuous improvement methodologies.

CO6: Develop quality improvement strategies to enhance organizational efficiency and competitiveness.

Unit No.	Lec No.	Topic	CO	Specific Objective	Expected Outcome	Book Referre d	From page to
	1	Introduction Objective, scope and outcome of the course	CO -1	Introduce the course objectives.	Understand the course structure.	B1	1-3
1	2	The meaning of Quality and quality improvement, dimensions of quality, history of quality methodology	CO -1	Explain the meaning of quality.	Define quality and its dimensions.	B1	4--8
1	3	Quality control, Quality of design and quality of conformance	CO -1	Describe quality control concepts.	Differentiate quality of design and conformance .	B2	3--7
1	4	Quality policy and objectives, Economics of quality.	CO -1	Explain quality policy and objectives.	Understand quality economics.	B2	17--18
1	5	Modeling process quality: Describing variation, frequency distribution,	CO -1	Introduce process quality modeling.	Describe process variation.	B3	64--66
1	6	Continuous and discrete, probability distributions	CO -1	Explain probability distributions.	Identify continuous and discrete distributions.	B3	72--75
1	7	Pattern of variation, Inferences about process quality	CO -1	Explain patterns of variation.	Interpret process quality variation.	B3	75
1	8	Sampling distributions and estimation of process parameters.	CO -1	Explain sampling distributions.	Estimate process parameters.	B3	104--110
1	9	Analysis of variance	CO -1	Introduce analysis of	Understand the basics of	B3	140--148



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				variance.	ANOVA.		
2	10	Statistical Quality Control: Concept of SQC,	CO-2	Explain the concept of SQC.	Understand Statistical Quality Control.	B1	265--266
2	11	Chance and assignable causes of variation,	CO-2	Explain causes of process variation.	Differentiate chance and assignable causes.	B1	267
2	12	Statistical basis of control chart, basic principles,	CO-2	Introduce control chart principles.	Understand the basis of control charts.	B1	267--269
2	13	Choice of control limits, sample size and sampling frequency,	CO-2	Explain selection of control limits.	Choose suitable sampling conditions.	B1	269, 279--280
2	14	Analysis of patterns on control charts. The magnificent seven	CO-2	Explain control chart patterns.	Interpret control chart signals.	B1	280--284
2	15	Control chart for variables,: X-bar and R charts, X-bar and S charts,	CO-2	Introduce variable control charts.	Use $\bar{X}$ -R and $\bar{X}$ -S charts.	B3	228--259
2	16	Control chart for individual measurement, Application of variable control charts.	CO-2	Explain individual control charts.	Apply variable control charts.	B1 B3	315--318 268
3	17	Control chart for attributes: control chart for fraction non conforming P-chart	CO-3	Explain P-chart concept.	Construct and interpret P-chart.	B1	369--384
3	18	np-chart	CO-3	Introduce np-chart.	Use np-chart for defectives.	B1	384--387
3	19	c-chart	CO-3	Explain c-chart.	Monitor number of defects.	B1	387--390
3	20	u-chart	CO-3	Explain u-chart.	Analyze defects per unit.	B1	390--396
3	21	Demerit systems, choice between attribute and variable control chart	CO-3	Explain demerit systems.	Select suitable control chart.	B3	326--327
3	22	SPC for short production runs.	CO-3	Introduce SPC for short runs.	Apply SPC in short production.	B3	206--208
3	23	Process capability analysis using histogram and probability plot,	CO-3	Explain process capability analysis.	Evaluate process capability.	B3	347--351
3	24	Capability ratios and concept of six sigma.	CO-3	Explain Six Sigma	Calculate capability	B2	514--525



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				concept.	ratios.		
4	25	Quality Assurance: Concept, advantages	CO-4	Explain quality assurance concepts.	Understand benefits of quality assurance.	B2	87--88
4	26	Field complaints, quality rating, quality audit	CO-4	Explain quality audit process.	Analyze complaints and audits.	B2	88--93
4	27	Acceptance Sampling: Fundamental concepts in acceptance sampling,	CO-4	Introduce acceptance sampling.	Understand sampling concepts.	B2	321--325
4	28	Operating Characteristics curve.	CO-4	Explain OC curve.	Interpret Operating Characteristic curve.	B2	325
4	29	Acceptance sampling plans,	CO-4	Explain sampling plans.	Select suitable sampling plan.	B2	335--327
4	30	Single, double and multiple sampling plans,	CO-4	Explain types of sampling plans.	Differentiate sampling methods.	B2	335--339
4	31	LTPD, AOQL, AOQ	CO-4	Explain LTPD, AOQL and AOQ.	Evaluate sampling performance.	B2	327--334
4	32	Introduction to Quality systems like ISO 9000 and ISO 14000.	CO-4	Introduce ISO quality systems.	Understand ISO 9000 and ISO 14000.	B2	489--513
	33	TPM	CO-4	Explain Total Productive Maintenance.	Understand TPM principles.	PPT	
5	34	Reliability and Life Testing: Failure models of components	CO-5	Introduce failure models.	Identify component failure models.	B1	529--531
5	35	Definition of reliability, MTBF	CO-5	Explain reliability and MTBF.	Calculate basic reliability measures.	B2	415--424
5	36	Failure rate, common failure rate curve, types of failure	CO-5	Explain failure rate concepts.	Identify different failure types.	B2	417
5	37	Reliability evaluation in simple cases of exponential failures in series,	CO-5	Explain series reliability.	Evaluate series system reliability.	B1	534--536
5	38	paralleled and series, parallel device configurations,	CO-5	Explain parallel configurations.	Evaluate parallel system reliability.	B1	536--542
5	39	Redundancy and improvement factors evaluations.	CO-5	Explain redundancy	Improve system	B2	419--423



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				methods.	reliability.		
5	40	Introduction to Availability and Maintainability	CO-5	Introduce availability and maintainability.	Understand availability concepts.	B2	424--432
5	41	Introduction to Taguchi Method of Design of Experiments, Quality loss function.	CO-6	Introduce Taguchi method and quality loss.	Apply basic DOE and quality loss concepts.	B1	559--623

Reference Books

B-1: Amitava Mitra, "Fundamentals of Quality Control & Improvement", WILEY

B-2: M. Mahajan, "Statistical Quality Control", Dhanpat Rai & Co.

B-3: Douglas.C.Montgomery, "Statistical Quality Control-A Modern Introduction", WILEY