



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171515

Semester – VII

Subject Name: Six Sigma and Lean Manufacturing

Type of course: Professional Core

Prerequisite: Nil

Rationale:

To gain insights about the importance of lean manufacturing and six sigma practices.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	<p>Lean Manufacturing Evolution of lean; traditional versus lean manufacturing; ford production system concept of lean; Toyota’s foray in lean, Customer Need; Lean tools: Process mapping value stream management- 3M; 7 types of Muda; 7 major losses reduction. cell layout; line balancing; Concept of kaizen; steps involved in kaizen deployment; Kanban concepts ; types of Kanban ; and practical application ; push vs pull; changeover time reduction - single minute exchange of die; concept of TPM; Poka-yoke; 5S; maintenance - preventive, time based and condition based; autonomous maintenance, JIT, Autonomation, DFMA; Lean metrics: Identify lean metrics; kaizen cloud identification in VSM ; lean assessment. improving targets and benchmarks;</p>	10
2	<p>Six Sigma: Historical Overview – Definition of quality – What is six sigma -TQM and Six sigma - lean manufacturing and six sigma- six sigma and process tolerance – Six sigma and cultural changes – six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing – assessment questions</p>	06
3	<p>The Scope of Tools and Techniques Tools for definition – IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project</p>	08



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	Charter – Tools for measurement – Check sheets, Histograms, Run Charts, Scatter Diagrams, Cause and effect diagram, Pareto charts, Control charts, Flow process charts, Process Capability Measurement, Tools for analysis – Process Mapping, Regression analysis, RU/CS analysis, SWOT, PESTLE, Five Whys, interrelationship diagram, overall equipment effectiveness, TRIZ innovative problem solving – Tools for improvement – Affinity diagram, Normal group technique, SMED, 5S, mistake proofing, Value stream Mapping, forced field analysis – Tools for control – Gantt chart, Activity network diagram, Radar chart, PDCA cycle, Milestone tracker diagram, Earned value management.	
4	Six Sigma Methodologies Design For Six Sigma (DFSS), Design For Six Sigma Method - Failure Mode Effect Analysis (FMEA), FMEA process - Risk Priority Number (RPN)- Six Sigma and Leadership, committed leadership – Change Acceleration Process (CAP)- Developing communication plan – Stakeholder	08
5	Six Sigma Implementation and Challenges Tools for implementation – Supplier Input Process Output Customer (SIPOC) – Quality Function Deployment or House of Quality (QFD) – alternative approach – implementation – leadership training, close communication system, project selection – project management and team – champion training – customer quality index – challenges – program failure, CPQ vs six sigma, structure the deployment of six sigma – cultural challenge – customer/internal metrics	08
6	Evaluation and Continuous Improvement Methods Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S	05
	Total Hour	45

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	10	20	40	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.



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Reference Books:

1. What is Lean Six Sigma, Michael L. George, David Rowlands, Bill Kastle, McGraw Hill.
2. Design for Six Sigma + Lean Toolset Implementing Innovations, Stephan Lunau Christian Staudter, Jens-Peter Mollenhauer, Renata Renata, Olin Roenpage, Clemens von Hugo, Alexis Hamalides, Springer,
3. Design for Six Sigma A Road Map for Product Development, Kai Yang, Basem S. El-Haik, McGraw-Hill Professional
4. Design for lean six sigma A holistic approach to design and innovation, Rajesh Jugulum, Philip Samuel, John Wiley & Sons.
5. Essentials of Lean Six Sigma, Salman Taghizadegan, Academic press, Elsevier
6. The Six Sigma Handbook, Thomas Pyzdek, Paul Keller, McGraw-Hill
7. Best Practices in Lean Six Sigma Process Improvement A Deeper Look, Richard J. Schonberger, John Wiley & Sons, Inc
8. Design and Analysis of Lean Production Systems, Ronald G. Askin and Jeffrey B. Goldberg, John Wiley and Sons, 2003
9. Rother M. and Shook J, 1999 =Learning to See: Value Stream Mapping to Add Value and Eliminate Muda, Lean Enterprise Institute, Brookline, MA.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Demonstrate the lean manufacturing fundamentals.	30
CO-2	Make use of different tools and techniques of six sigma for quality improvement.	20
CO-3	Evaluate and interpret methodology of six sigma.	25
CO-4	Take part in implementation of six sigma and its improvement in industry.	25

List of Experiments:

Experiments are as per above contents and should include case study and demonstration of below mentioned topics.

- 1) Case study and demonstration of lean tools and techniques.
- 2) Exercise on six sigma: Tools and techniques
- 3) Demonstration of Kiazen, 5S, SWOT,