

AMRUTVAHINI COLLEGE OF ENGINEERING, SANGAMNER
Department of Mechanical Engineering
Honors in Lean Manufacturing (18 Credits)

Year	Semester	Course Code	Course Name	Credits
Second Year	Sem III	R25-ME-HOC-201	Foundations of Lean Manufacturing	3
	Sem IV	R25-ME-HOC-202	Toyota Production System	3
Third Year	Sem V	R25-ME-HOC-301	Manufacturing Strategy	3
	Sem VI	R25-ME-HOC-302	Lean Management and Six Sigma	3
Final Year	Sem VII	R25-ME-HOC-401	Advanced Lean Manufacturing	3
	Sem VIII	R25-ME-HOC-402	Sustainability through Green Manufacturing Systems	3


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CO4	ANALYZE manufacturing processes to improve productivity, quality, flow, lead time, and resource utilization	4
CO5	APPLY the concepts of Pull System, Just-in-Time, Kanban, and continuous improvement to suitable manufacturing situations.	3
Course Contents		
Unit 1	Introduction to Lean Manufacturing	Weeks 1-2
Evolution and history of Lean Manufacturing; Lean philosophy and principles; customer value and value-added activities; types of waste (Muda); Lean Manufacturing versus traditional manufacturing; benefits, challenges, and applications of Lean Manufacturing.		
Exemplars / Practical Applications and usage: Study of Lean implementation in automotive, automobile component, electronics, and general manufacturing industries. Identification of the 8 wastes in a real or simulated production process.		
Assignments: Identify and analyze Lean wastes in a selected manufacturing process and suggest suitable improvement measures		
Unit 2	Lean Flow and Process Improvement	Week 3
Process flow and continuous flow; takt time, cycle time, lead time, and throughput; bottlenecks and process constraints; push and pull production systems; Just-in-Time (JIT) principles; introduction to Value Stream Mapping (VSM).		
Exemplars / Practical Applications and usage: Application of takt time, cycle time, lead time, process flow, bottleneck identification, and Value Stream Mapping in production systems. Comparison of push and pull production systems.		
Assignments: Prepare a current-state Value Stream Map of a simple manufacturing process and identify opportunities for reducing lead time and non-value-added activities.		
Unit 3	Fundamental Lean Tools	Weeks 4-5
5S methodology; visual management and visual controls; standardized work; Kaizen and continuous improvement; Poka-Yoke (error proofing); basic problem-solving approaches including PDCA and 5W1H.		
Exemplars / Practical Applications and usage: Application of 5S, Kaizen, Visual Management, Standardized Work, Poka-Yoke, PDCA, and 5W1H in workshops, laboratories, offices, and manufacturing environments.		
Assignments: Conduct a 5S audit of a laboratory/workshop and develop an improvement plan with before-and-after observations		
Unit 4	Lean Production Systems	Week 6
Kanban system and types of Kanban; supermarket and FIFO systems; Heijunka (production leveling); cellular manufacturing; one-piece flow; setup time reduction and SMED; line balancing and workload leveling..		

Exemplars / Practical Applications and usage: Application of Kanban, FIFO, Heijunka, cellular manufacturing, one-piece flow, SMED, and line balancing for improving material flow and reducing inventory and setup time.														
Assignments: Develop a Kanban system or balance a production line for a selected manufacturing process and evaluate the improvement in productivity and flow.														
Unit 5		Lean Implementation and Continuous Improvement										Weeks 7-8		CO5
Lean implementation framework; Lean culture and employee involvement; Gemba and Gemba Walk; fundamentals of Total Productive Maintenance (TPM); Lean performance measures and KPIs; Lean implementation challenges and sustainability; introduction to Lean Six Sigma and Smart/Digital Lean Manufacturing.														
Exemplars / Practical Applications and usage: Application of Gemba Walk, TPM, Lean KPIs, employee involvement, continuous improvement, and Lean Six Sigma concepts in manufacturing organizations. Introduction to digital tools for monitoring Lean performance.														
Assignments: Conduct a Gemba-based study of a selected process, identify improvement opportunities, propose Lean solutions, and evaluate suitable performance indicators before and after improvement.														
Textbooks:														
1. Womack, J. P., and Jones, D. T., <i>Lean Thinking: Banish Waste and Create Wealth in Your Corporation</i>, Free Press. 2. Liker, J. K., <i>The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer</i>, McGraw-Hill. 3. Rother, M., and Shook, J., <i>Learning to See: Value Stream Mapping to Add Value and Eliminate Muda</i>, Lean Enterprise Institute. 4. Ohno, T., <i>Toyota Production System: Beyond Large-Scale Production</i>, Productivity Press. 5. Dennis, P., <i>Lean Production Simplified: A Plain-Language Guide to the World's Most Powerful Production System</i>, Productivity Press.														
Reference Books:														
1. George, M. L., <i>Lean Six Sigma: Combining Six Sigma Quality with Lean Production Speed</i>, McGraw-Hill. 2. Imai, M., <i>Kaizen: The Key to Japan's Competitive Success</i>, McGraw-Hill. 3. Shingo, S., <i>A Study of the Toyota Production System: From an Industrial Engineering Viewpoint</i>, Productivity Press. 4. Bicheno, J., and Holweg, M., <i>The Lean Toolbox: A Handbook for Lean Transformation</i>, Picsie Books. 5. Womack, J. P., Jones, D. T., and Roos, D., <i>The Machine That Changed the World</i>.														
MOOCs Links and additional reading material:														
1. Foundations of Lean Manufacturing (NPTEL – IIM Bangalore) https://onlinecourses.swayam2.ac.in/e-learning/preview/imb24_mg119														
Strength of CO-PO-PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	–	1	1	-	1	1	2	2	2	2	1
CO2	3	3	2	1	2	1	-	-	1	2	2	3	3	2

CO3	2	3	3	1	3	1	-	-	2	2	2	3	3	3
CO4	3	3	3	2	3	1	-	-	2	2	2	3	3	3
CO5	3	3	3	2	3	2	-	-	2	2	3	3	3	3
Avg.	2.8	2.8	2.4	1.2	2.4	1.2	1.0	1	1.6	2.0	2.2	2.8	2.8	2.4

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern							
a) Continuous Comprehensive Evaluation (CCE) – 40 Marks							
The Continuous Comprehensive Evaluation shall be carried out by the Department based on the student's performance throughout the duration of the SWAYAM-NPTEL course. - Performance in NPTEL Weekly Assignments: 30 Marks - Course Progress and Participation (completion of video lectures, timely submission of weekly assignments, and periodic progress monitored by the Faculty Mentor): 10 Marks							
b) End Semester Evaluation (ESE) – 60 Marks							
- Students shall register for and appear in the SWAYAM-NPTEL Proctored Certification Examination. - The marks obtained in the NPTEL Proctored Examination shall be converted proportionally to 60 marks using the following formula: - Students who successfully obtain the NPTEL certificate shall have the converted score considered as the End Semester Evaluation (ESE) marks. - Students who fail to obtain the NPTEL certificate, fail to appear for the NPTEL certification examination, or fail the certification examination shall appear for the Institute End Semester Examination conducted by the College. - If a student appears for both the SWAYAM-NPTEL Certification Examination and the Institute End Semester Examination, the higher of the two ESE scores shall be considered for the award of the final grade. - The decision of the Department regarding verification of NPTEL scores and award of marks shall be final and binding.							
BT Level	CCE						ESE
	CT1	CT2	Assignments	Course Project	Field Activity / Case Study	Quiz / presentation etc.	
K1	-	-	✓	-	-	-	✓
K2	-	-	✓	-	-	-	✓
K3	-	-	✓	-	-	-	✓
K4	-	-	✓	-	-	-	✓
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-

This course provides students with fundamental knowledge of Lean Manufacturing principles, waste elimination, process improvement, and continuous improvement practices, along with practical understanding of tools such as 5S, Kaizen, Value Stream Mapping, Kanban, Poka-Yoke, and Just-in-Time. It develops the ability to improve productivity, quality, process flow, resource utilization, and operational efficiency, preparing students for industry roles in production, manufacturing, industrial engineering, quality, and continuous improvement.

Job Mapping:

- Lean Manufacturing Engineer – Waste reduction and process improvement.
- Production Engineer – Productivity, flow and line balancing.
- Industrial Engineer – Process analysis and optimization.
- Quality Engineer – Defect prevention and continuous improvement.
- Operations Engineer – JIT, Kanban and production planning.