SEMESTER S7

LEAN MANUFACTURING

Course Code	**PEMET746**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Students will able to learn about lean manufacturing, types of industrial wastes associated and tools for eliminating the wastes.
2. Students will understand about the lean elements and identify those within industries.
3. Students can understand the concept of six sigma and agile manufacturing.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction - History of Lean – Toyota Production System (TPS)- Ford Production System (FPS)- Principle of Lean Manufacturing- Seven Wastes, their causes and the effects- Conventional Manufacturing versus Lean Manufacturing	8
2	Tools of Lean manufacturing: 5-S, Workplace organization, Total Productive Maintenance, Process mapping/ Value stream mapping, Work cell, Cause and Effect diagram, Pareto chart, Spider chart, Poka yoke, Kanban, Automation, Single minute exchange of die (SMED), Just in time (JIT), Visual workplace, OEE	10
3	Lean elements: Introduction to Lean Concepts like In-Built Quality, Concept of Right Part at the Right Time, Lead Time reduction, Optimum utilization of Capital, Optimum utilization of People. Understanding the Zero-defect concept and Metrics, Focus on Human Resources, Quality and Delivery Cost. Building Zero defect capabilities, Cultural and Organizational aspects	8

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4	Six Sigma Fundamentals: Introduction to six sigma- basic tools of six sigma like problem solving approach, standard deviation, normal distribution. DMAIV and DMADV. Agile Manufacturing: Agile manufacturing - Definition, business need, conceptual frame work, characteristics, and generic features -Approaches to enhance ability in manufacturing - Managing people in agile organization	**10**

Course Assessment Method
(CIE: 40marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

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End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Identify and understand the key concepts in lean manufacturing.	**K1, K2**
CO2	Select the lean manufacturing tools to find and eliminate wastes	**K3**
CO3	Identify and improve a manufacturing system by applying lean manufacturing principles and tools	**K3**
CO4	Understanding the key concepts of six sigma	**K2**
CO5	Identify the framework of agile manufacturing	**K1, K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	-	-	-	-	3	3	3	3	3	2	3
CO2	1	-	-	-	-	2	3	2	3	3	2	3
CO3	1	-	-	-	-	3	3	2	3	3	2	3
CO4	1	-	-	-	-	3	3	2	3	3	2	3
CO5	1	-	-	-	-	3	3	2	3	3	2	3

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Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The Machine that Changed the World: The Story of Lean Production	James P. Womack, Daniel T. Jones, and Daniel Roos	Simon & Schuster	1996
2	Becoming Lean	Jeffrey K. Liker	Industrial Engineering and Management Press	1997
3	Demystifying six sigma: a company-wide approach to continuous improvement	Larson, Alan	Jaico, Mumbai	2007
4	Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities	S.R. Devadasan, V. Mohan Sivakumar, R. Murugesh and PR Shalij	PHI Learning private Limited, New Delhi	2012
5	The Cambridge International Handbook of Lean Production	Thomas Janoski, Darina	Cambridge University Press	1, 2021

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Lean Thinking	James P. Womack and Daniel T. Jones	Free Press-Business and Economics	2003
2	Learning to See	Rother M. and Shook J	The Lean Enterprise Institute, Brookline	2003
3	Lean six sigma: combining six sigma quality with lean speed	George, Michael. L.	Tata McGraw Hill Education, New Delhi	2002
4	Lean Evolution	Nick Rich, Nicola Bateman,	Cambridge University Press	1, 2012

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/112/104/112104188/
2	https://archive.nptel.ac.in/courses/112/104/112104188/
3	https://archive.nptel.ac.in/courses/112/104/112104188/
4	https://archive.nptel.ac.in/courses/112/104/112104188/

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