SEMESTER S4

LEAN MANUFACTURING

Course Code	PERUT413	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	NIL	Course Type	Theory

Course Objectives:

1. Understand Lean Manufacturing Fundamentals
2. Apply Lean Tools and Techniques
3. Enhance Quality and Process Improvement
4. Promote Lean Culture and Employee Engagement

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to Lean Manufacturing:** The Mass Production System vs. Lean Production System, Origins and Necessity of Lean Manufacturing, Lean Revolution: Toyota Production System (TPS), Systems Thinking in Lean, Basic Principles of Lean Production, Customer Focus in Lean, Overview of Waste (MUDA)	9
2	**Tools and techniques for Lean Manufacturing:** 5S System (Sort, Set in Order, Shine, Standardize, Sustain), Total Productive Maintenance (TPM), Standardized Work and its Elements, Introduction to Just In Time (JIT), Kanban System and Pull Production, Value Stream Mapping (VSM)	9
3	**Quality improvement:** Jidoka (Automation with a Human Touch), Poka-Yoke (Mistake Proofing) Systems, Six Sigma: Concepts and Methodology, Introduction to Quality Function Deployment (QFD), Failure Modes and Effects Analysis (FMEA), Total Quality Management (TQM) Tools and Techniques	9
4	**Employee involvement and continuous improvement:** Worker Involvement Techniques (Quality Circles, Suggestions Programs), Kaizen Philosophy and Practices, Hoshin Planning (Systematic Planning Methodology), Lean Culture and its Importance, Overview of Concurrent Engineering, Basics of Design of Experiments (DoE)	9

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Course Assessment Method

(CIE: 40 marks, 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

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**

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Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Understand the fundamental principles and historical development of Lean Manufacturing, emphasizing waste reduction and systems thinking.	**K2**
CO2	Apply primary Lean tools such as 5S, TPM, standardized work, JIT, and Kanban to improve operational efficiency.	**K3**
CO3	Implement quality improvement techniques like Jidoka, Poka-Yoke, Six Sigma, and TQM to enhance product quality and reliability.	**K4**
CO4	Foster employee involvement through techniques like Kaizen and quality circles, and implement systematic planning methodologies to sustain Lean practices.	**K5**

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Lean Production Simplified	Pascal Dennis	Tata McGraw Hill	Third edition, 2015
2	The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer	Jeffrey K. Liker	Tata McGraw Hill	First edition, 2004
3	Lean Thinking: Banish Waste and Create Wealth in Your Corporation	James P. Womack and Daniel T. Jones	Simon & Schuster India	Second edition, 2002
4	The Machine That Changed the World: The Story of Lean Production	James P. Womack, Daniel T. Jones, and Daniel Roos	Free Press India	Revised edition, 2007

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Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Lean Six Sigma: Combining Six Sigma Quality with Lean Production Speed	Michael L. George	McGraw Hill	First edition, 2002
2	Toyota Production System: Beyond Large-Scale Production	Taiichi Ohno	Taylor & Francis, Inc.	Reprint Edition, 2019
3	Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA	Mike Rother and John Shook	Lean Enterprise Institute	First edition, 1999

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