Course Code	Course Title	L	T	P	C
BMEE412E	Manufacturing Systems Design	3	0	2	4
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To design and control manufacturing systems through a science-based understanding of production system operations and flow.
2. To impart the knowledge of various manufacturing systems configuration and analysis.
3. To describe the concept of information systems for manufacturing excellence.

Course Outcomes

On successful completion of this course, students will be able to:

1. Describe the concepts, structure and functions of manufacturing systems.
2. Develop mathematical modelling and analysis for various manufacturing systems.
3. Analyse the impact of variability on the key performance measures of a manufacturing system.
4. Apply various methods and algorithms for production scheduling problems.
5. Comprehend the significance of information flow in manufacturing systems design.
6. Interpret the manufacturing systems through simulation modelling.

Module:1	Essentials of Manufacturing Systems	5 hours

Structural, transformational and procedural aspects of manufacturing systems- Integrated manufacturing management systems: Basic functions and structures of management systems, framework of an integrated manufacturing system.

Module:2	Cellular Manufacturing Systems	7 hours

Cellular Manufacturing: Composite Part Concept, Machine Cell Design - Analysis of Cellular Manufacturing: Rank-order Clustering, Hollier heuristic approach – Mathematical program for group formation - Performance Metrics in Cell Operations.

Module:3	Scheduling for Manufacturing Systems	7 hours

Optimization of single machine scheduling problem: Dynamic programming approach, branch and bound approach-Flow shop scheduling: Two-machine problem, minimization of makespan-Job shop scheduling: Bottleneck procedure, neighbourhood search heuristics.

Module:4	Flexible manufacturing systems	6 hours

Introduction – System components – System design – System setup: mathematical modelling for part selection and loading problems – Heuristic approach – Analysis of flexible manufacturing systems.

Module:5	Assembly Systems	7 hours

Fundamentals of Manual Assembly Lines - Analysis of Single-Model Assembly Lines - Line Balancing Algorithms - Workstation Details – Fundamentals of Automated Assembly Systems - Analysis of Automated Assembly Systems.

Module:6	Information Systems for Manufacturing	6 hours

Management information system and strategic information system-Information networking-Parts-oriented production information systems-Computerised production scheduling: Interactive group scheduling technique, Computer-aided line

balancing-On-line production control systems-Computerised production management-Computerised manufacturing information systems.		
Module:7	**Simulation for Manufacturing Systems**	**5 hours**
Introduction: Discrete and continuous simulation - Simulation modelling: Serial lines, Flexible manufacturing.		
Module:8	**Contemporary Issues**	**2 hours**
	Total Lecture hours:	**45 hours**

Indicative Experiments	
1.	Manufacturing system with multiple work stations
2.	Machine failure and repair
3.	Batch processing
4.	Assembly operations
5.	Line balancing
6.	Manufacturing system with multiple products
7.	Part selection and loading
8.	Kanban flow
9.	Material handling systems
10.	Shop floor scheduling etc.

Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Katsundo Hitomi, Manufacturing Systems Engineering, Taylor and Francis, 2017
2.	Mikell P. Groover, *Automation, Production Systems, and Computer-Integrated Manufacturing*, 2015, 4th Edition, Pearson Higher Education, Inc., Upper Saddle River, New Jersey
3.	Ronald G. Askin, Charles R. Standridge, Modeling and Analysis of Manufacturing Systems, 1993, John Wiley & Sons, Inc., New York
Reference Books	
1.	Kenneth R. Baker and Dan Trietsch, Principles of Sequencing and Scheduling, Prentice Hall, 2019, Second Edition
2	Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol, *Discrete Event system Simulation*, 2010, 5th Edition, Pearson Education, Inc.

Mode of assessment: Continuous assessment, and FAT			
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