SMART MANUFACTURING

Coursecode		Year	IV	Semester	I
Course category	Professional Elective - V	Branch	ME	CourseType	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Manufacturing Processes
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes: At the end of the course students will be able to

CO's	Statement	Blooms Level	Units
CO1	Explain the evolution, stages ,and benefits of smart manufacturing, Industry4.0 and Industry5.0	L2	1
CO2	Identify and describe smart sensors, subsystems ,and interfaces used in IIoT-based manufacturing	L2	2
CO3	Analyze CPS functions and compare traditional manufacturing with Industry4.0CPS- based systems	L3	3
CO4	Explain digital twin implementation and apply AI/ML concepts for predictive Maintenance in manufacturing	L2	4
CO5	Understand and differentiate IoT network layers and protocols used in Industry 4.0 applications	L3	5

ContributionofCourseoutcomestowardsthe achievementofprogram outcomes &Strengthofcorrelations(High :3,Medium:2,Low:1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1		2						3	2	2
CO2	3	3	2	1	3				1		2	3	2
CO3	3	3	3	2	2				1	1	2	3	2
CO4	3	2	3	2	3			1	1	2	3	3	3
CO5	3	3	2	1	3				1	2	2	3	3

Unit	Contents	CO
I	**CONCEPTS OF SMART MANUFACTURING**: Definition and key characteristics of smart manufacturing, Corporate adaptation processes, manufacturing challenges, challenges vs technologies, Overview of circular manufacturing, Stages in smart manufacturing. Minimizing Six big losses in manufacturing with Industry 4.0, Industry 5.0, and their benefits	**CO1**
II	**SMART MACHINES AND SMART SENSORS:** Concept and Functions of a Smart, Machine Salient features and Critical Subsystems of a Smart Machine, Smartsensors;smartsensorsecosystem,need,benefitsandapplicationsofsensors in industry, Sensing for Manufacturing Process in IIoT, Block Diagram of a IoT Sensing Device, Sensors in IIoT Applications, Smart Machine Interfaces	**CO2**
III	**ARCHITECTUREOFCYBER-PHYSICALSYSTEM(CPS):** Functions of CPS, 5C Architecture; Smart Connection Level, Data-to- Information Level, Cyber Level, Cognition Level, Configuration Level. Design of PHM based CPS systems. Comparison of today's factory and Industry 4.0 factory by the implementation of 5C CPS architecture	**CO3**
IV	**DIGITALTWIN:** Introduction, applications of digital twins, impact zones of digital twins in manufacturing(factories/plantsandOEMs),advantagesofdigital twins, basic steps of digital twin technology, Multiverse and AR and VR. **MACHINELEARNING(ML)ANDARTIFICIALINTELLIGENCE(AI) INMANUFACTURING**:Introduction,benefitsandapplicationsofMLinindustries, commonapproachesofML;supervisedandunsupervised,semi-Supervised and reinforced ML, Application of AI and ML for predictive maintenance	**CO4**
V	**IOT CONNECTIVITY FOR INDUSTRY 4.0:** Industrial communication requirement and its infrastructure, an overview of different types of networks, mesh network in industrial IoT, IoT protocols and the internet, TCP/IP (transmission control protocol/internet protocol) model, IoT connectivity standards:commonprotocols,applicationlayerprotocols,internet/networklayer protocols, physical layer IoT protocols.	**CO5**

LearningResource
Textbooks:
TEXT BOOKS: 1. Industry4.0 The Industrial Internet of Things by AlasdairGilchrist, Apress 2. Industrial Internet of Things, Cyber Manufacturing System by SabinaJeschke,Christian Brecher, Houbing Song Danda B. Rawat, Springer