

Course Code	Course Title	L	T	P	C
BMEE410L	Industrial Revolution 4.0	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			
Course Objectives					
<ol style="list-style-type: none"> 1. To understand the basics of the relevant technologies used within Industry 4.0. 2. To explore the architectures, and various frameworks used in Industrial Revolution 4.0 3. To understand the applications of selected technologies for manufacturing. 4. To understand various protocols for network security to protect against the threats in the networks. 					
Course Outcomes					
<ol style="list-style-type: none"> 1. Knowledge of theory and practice related to Industrial IoT System 2. Understand the existing IoT, Frameworks in Industrial Revolution 4.0 and Cloud manufacturing. 3. Design an IoT system for intelligent manufacturing. 4. Analyze and resolve security issues in networks and Industrial Revolution 4.0 to secure an IT infrastructure. 5. Share data and information in the digital thread across enterprise-level information system. 6. Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability. 					
Module:1	Fundamentals of Industry 4.0	6 hours			
Industry 4.0 -Introduction to the industrial internet- Industry 4.0 components – Industry 4. 0 principles- Impact of industry 4.0 -Designing industrial internet systems					
Module:2	Frameworks	6 hours			
Reference Architecture - Reference architecture model industry 4.0- Purdue Enterprise Reference Architecture - IIoT reference architecture -Cloud Manufacturing - Architecture, models, and frameworks.					
Module:3	Digital Twin Technology	6 hours			
Implementing Manufacturing Execution System- Digital twin modeling - Cyber-Physical systems - Digital Twin Shop-floor - digital twin and virtual Reality, Augmented Reality and Mixed Reality					
Module:4	Intelligent Manufacturing	6 hours			
Intelligent Manufacturing Platforms-GE:Predix, PTC: ThingWorx, Smart factory, Predictive analytics for Intelligent manufacturing- Cloud ML platform.					
Module:5	Network technology and protocols	6 hours			
Examining the access network technology and protocols- Examining the middleware transport protocols – Middleware software patterns - IIoT WAN technologies and protocols					
Module:6	Security Framework	6 hours			
Software design concepts – Middleware industrial internet of things platforms – Securing the industrial internet					
Module:7	Future Factories	7 hours			

Blockchain, smart contracts, Cognitive computing, Metaverse, OpenAI platforms API and cloud based integration for Industrial Applications - Big Data and Cloud Computing - ML algorithms, AI applications in manufacturing		
Module:8	Contemporary Issues	2 hours
Total Lecture hours:		45 hours
Text Book(s)		
1.	Gilchrist, Alasdair. Industry 4.0: The Industrial Internet of Things. United States: Apress, 2016.	
2.	Ackerman, Pascal. Industrial Cybersecurity: Efficiently Secure Critical Infrastructure Systems. United Kingdom: Packt Publishing, 2017.	
3.	Zindani, Divya., Davim, J. Paulo., Kumar, Kaushik. Industry 4.0: Developments Towards the Fourth Industrial Revolution. Germany: Springer Singapore, 2019.	
4.	Tao, Fei., Nee, A.Y.C., Zhang, Meng. Digital Twin Driven Smart Manufacturing. United Kingdom: Elsevier Science, 2019.	
Reference Books		
1.	Knapp, Eric D., Langill, Joel. Industrial Network Security: Securing Critical Infrastructure Networks for Smart Grid, SCADA, and Other Industrial Control Systems. Netherlands: Elsevier Science, 2014.	
2.	Macaulay, Tyson, Singer, Bryan L. Cybersecurity for Industrial Control Systems: SCADA, DCS, PLC, HMI, and SIS. United States: CRC Press, 2016.	
3.	Blokdyk, Gerardus. Cloud Manufacturing a Complete Guide - 2020 Edition. N.p.: Emereo Pty Limited, 2020.	
Mode of Evaluation: CAT / written assignment / Quiz / FAT		
Recommended by Board of Studies		03-03-2023
Approved by Academic Council		No. 69 01-03-2023