GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Subject Code: ME02000901

Subject Name :Industry 4.0

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Nil
Rationale:	The Fourth Industrial Revolution, driven by advancements in smart technologies, is transforming decision-making and automation processes. Progress in IT has significantly enhanced computational power and connectivity, enabling a highly networked society. Digital platforms in the Cloud serve as a foundation for innovative business models and intelligent algorithms that analyze data to generate actionable insights for cyber-physical systems. This revolution brings immense opportunities, such as leveraging data for operational efficiencies and developing new business models. The subject provides a comprehensive exploration of Industry 4.0, covering technologies, manufacturing systems, applications, and case studies.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
1	Understand the basic concepts of Industry 4.0 and the other related fields.
2	Illustrate cyber physical system, drivers and enablers of Industry 4.0 and the emerging applications
3	Demonstrate the smartness in Smart Factories, Smart workplace.
4	Appreciate the power of Cloud Computing in a networked economy
5	Analyze digital twins, Assistance system in production and Interoperability.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	30	20	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Industry 4.0:** Introduction, Historical Context, General framework, Application areas, Dissemination of Industry 4.0 and the disciplines that contribute to its development, Artificial Intelligence, The Internet of Things and Industrial Internet of Things, Additive manufacturing, Robotization and automation, Current situation of Industry 4.0. Introduction to Industry 4.0 to Industry 5.0 Advances	06	14
2.	**Basic Principles and Technologies of a Smart Factory:** Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of services, Big data, Cyber physical systems, Value chain in manufacturing industries, customization of products, Digital twins, cloud computing introduction and cloud manufacturing, Securities issues within Industry 4.0 Networks.	06	14
3.	**Cyber Physical Systems (CPS) and Cyber Production Systems (CPPS):** CPS Definitions, Demarcation to embedded systems, ubiquities of computing, etc.., Core elements of CPS and CPPS, Control theory and real time requirements, Self organization principles: Self -X, Autonomy, Negotiations. Communication in CPS, Design methods for CPS: Modelling, Programming, Model Integrated Development. Application of CPS and CPPS.	08	20
4.	**Smart Workpiece**: Intelligent Workpiece, Workpiece tagging, QR code and RFID technology, Communication technology between workpiece and environment, Multi agent systems in Production, Applications for smart workpiece, and future applications in the field of Manufacturing.	04	10
5.	**Digital Twins in Production:** Basic concepts of Digital twins, Benefits, Impact and Challenges, Features and Implementation of digital twins. Types of digital twins, Digital twins use cases, Applications of digital twins in Production/Manufacturing.	04	10
6.	**Assistance systems for Production/Manufacturing:** Industry 4.0 scenario for worker, Diversity driven/Barrier free workplaces, Accessibility in production, Human and task centered assistance systems, Mobile information technologies, Shop floor information systems, Production line support system, Augmented reality in Manufacturing, Virtualization, Introduction of Cloud based ERP and cloud manufacturing. IT security and cloud applications.	09	20
7	**Interoperability:**	08	**12**

	Communication systems and standards for Industry 4.0 and cloud application, Industrial communication, Industrial Internet of Things, Industry 4.0 reference architecture model, Basics on service-oriented architecture, Future standard in Industry 4.0, Machine to Machine interaction in practice.		
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**20**	**20**	**20**	**20**	**10**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Jean-Claude André, Industry 4.0, Wiley- ISTE, July 2019, ISBN: 781786304827,2019.
2. Diego Galar Pascual, Pasquale Daponte, Uday Kumar, Handbook of Industry 4.0 and SMART Systems, Taylor and Francis,2020
3. Miller M, The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the world‖, Pearson Education, 2015, ISBN: 9780134021300.
4. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
5. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Studylab Publications, 2016.
6. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.
7. Jean-Claude André, ―Industry 4.0, Wiley- ISTE, July 2019, ISBN 781786304827,2019.
8. Diego Galar Pascual, Pasquale Daponte, Uday Kumar, ―Handbook of Industry 4.0 and SMART Systems‖ Taylor and Francis,2020
9. Miller M, ―The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the world‖, Pearson Education, 2015, ISBN: 9780134021300.

(b) Open-source software and website:

1. https://nptel.ac.in/courses/106/105/106105195/
2. https://www.nsf.gov/news/special_reports/cyber-physical/

Suggested Course Practical List:

List of Laboratory/Learning Resources Required:

Suggested Activities for Students: Any activity based on above syllabus content

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