GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161716
INDUSTRY 4.0
6th SEMESTER

Type of course: Core Engineering

Prerequisite: Sensor/ transducer, field transmitters, converters, final control element, Computer based control system architecture, Basics of Internet of Things (IoT)

Rationale: The world is at the onset of the Fourth Industrial Revolution and this revolution is very much driven by the smarts in automating decision making and processes. Advancements in IT has resulted in immense improvements in computational power across nearly all electronic devices and enhanced capabilities in connecting the dots in an increasingly networked society. Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. This course provides learners an introduction to Industry 4.0 (or the Industrial Internet), its applications in the business world. Learners will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

S. N.	Content	Total Hrs	% Weigh tage
1	Module 1: Introduction to Industry 4.0 1.1 The Various Industrial Revolutions 1.2 Digitalisation and the Networked Economy 1.3 Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 1.4 The Journey so far: Developments in USA, Europe, China and other countries 1.5 Comparison of Industry 4.0 Factory and Today's Factory 1.6 Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation	08	21
2	Module 2: Road to Industry 4.0 2.1 Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services 2.2 Smart Manufacturing 2.3 Smart Devices and Products 2.4 Smart Logistics 2.5 Smart Cities 2.6 Predictive Analytics	06	16

3	Module 3: Related Disciplines, System, Technologies for enabling Industry 4.0 3.1 Cyberphysical Systems 3.2 Robotic Automation and Collaborative Robots 3.3 Support System for Industry 4.0 3.4 Mobile Computing 3.5 Related Disciplines 3.6 Cyber Security	08	21
4	Module 4: Role of data, information, knowledge and collaboration in future organizations 4.1 Resource-based view of a firm 4.2 Data as a new resource for organizations 4.3 Harnessing and sharing knowledge in organizations 4.4 Cloud Computing Basics 4.5 Cloud Computing and Industry 4.0	08	21
5	Module 5: Other Applications and Case Studies 5.1 IIoT case studies 5.2 Case studies from students	04	10
6	Module 6: Business issues in Industry 4.0 6.1 Opportunities and Challenges 6.2 Future of Works and Skills for Workers in the Industry 4.0 Era 6.3 Strategies for competing in an Industry 4.0 world	04	11

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
07	**14**	**14**	**14**	**14**	**07**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Text Books

1. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", *Apress, 2016*

2. Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies Rapid Prototyping to Direct Digital Manufacturing", *Springer, 2010.*

3. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, "Industrial Internet of Things: Cyber manufacturing Systems" *(Springer)*

4. A. McEwen and H. Cassimally, Designing the Internet of Things, 1st edition, *Wiley, 2013, ISBN-10: 111843062X*

5. A. Bagha and V. Madisetti, Cloud Computing: A Hands-on Approach, *1st edition, Universities press, 2015, ISBN-10: 8173719233.*

6. B. Evans, Beginning Arduino Programming – Writing Code for the Most Popular Microcontroller Board in the World, *1st edition, Apress, 2011, ISBN13: 9781430237778.*

7. S. Chin and J. Weaver, Raspberry Pi with Java: Programming the Internet of Things (IoT), *1st edition, McGraw Hill Publisher, 2015, ISBN-10: 0071842012.*

Reference Books:

1. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
2. J. Chanchaichujit, A.Tan, Meng, F., Eaimkhong, S. "Healthcare 4.0 Next Generation Processes with the Latest Technologies", Palgrave Pivot, 2019.
3. F. Lamb, Industrial Automation: Hands on, 1st edition, McGraw-Hill Education, 2013, ISBN-10:0071816453
4. M. Kuniavsky, Smart Things: Ubiquitous Computing User Experience Design, 1st edition, Morgan Kaufmann, 2010, ISBN-10: 0123748992
5. Industrial Internet Vocabulary - IIC
6. The Industrial Internet of Things Volume G1: Reference Architecture – IIC
7. Industrial Internet of Things Volume G4: Security Framework –IIC

Course Outcomes: Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the drivers and enablers of Industry 4.0	
CO-2	Appreciate the smartness in Smart Factories, Smart cities, smart products and smart services	
CO-3	Outline the various systems used in a manufacturing plant and their role in an Industry 4.0 world	
CO-4	Understand the opportunities, challenges brought about by Industry 4.0 and how organisations and individuals should prepare to reap the benefits	
CO-5	Publish and distribute Android Application	

List of Practical:

Introduction to Microcontrollers and Sensors.

Prototyping Embedded devices using Arduino/ Raspberry Pi/ BeagleBone Black/ etc. notable platforms

I/O control interface programming.

Communication protocol implementation and testing using Microcontroller.

Configuring Wired/Wireless network interface to Microcontroller and programming

Configuring cloud database management and accessing

Sensors, Gateway and Cloud interface

Data analysis from cloud and reporting

Prototyping online Components – Getting Started with an API, Writing a New API, Real Time Reactions, Other Protocols.

Major Equipment:

List of Open Source Software/learning website:

http://vlab.co.in/
www.isa.org
http://nptel.ac.in/video.php
http://www.idc-online.com/
https://www.i-scoop.eu/industry-4-0/
https://new.siemens.com/in/en/company/topic-areas/digital-enterprise.html