

No	Information of subject	
1	Unit name:	Industrial Automation
2	Code:	McE 51039
3	Classification:	Engineering subject
4	Credit value:	2
5	Semester/ Year Offered:	1/5
6	Pre-requisite:	
7	Mode of delivery:	Lecture, Presentation, Discussion
8	Assessment system and breakdown of marks:	Assignment
	Mid-term/ final Examination	70%
	Assignment/Home work /Practical	30%
9	Academic staff teaching unit:	Department of Mechatronic Engineering
10	<p>Course outcome of unit:</p> <p>In this course, students will be able</p> <ul style="list-style-type: none"> <li>(a) To distinguish data communication and networking process</li> <li>(b) To identify the fieldbus architecture and foundation of fieldbus data type</li> <li>(c) To extend the knowledge of PROFIBUS and MODBUS</li> </ul>	
11	<p>Synopsis of unit:</p> <p>The course particularly introduce students to the wireless fieldbus, which offers a multitude of benefits in the field of process control and automation. Fieldbus and Networking in Process Automation provides a clear, concise, and comprehensive coverage of fieldbuses as used in the process control and automation industries. Fieldbus and networking is an emerging area and is increasingly being applied in process industries. It is very helpful for engineering students in the area of instrumentation, process, electrical, electronics, and computer science disciplines, and give adequate exposure about the different fieldbus technologies in use today. Chapter 1 introduce the data communication, refers to transfer of information from one place to another. Chapter 2 describe about the field of communication has expended at a very first pace over the last several decades, which call networking. Chapter 3 refers to classify the networking models. Chapter 4 points out the importance of network in process automation. Chapter 5 introduce a local area network, Fieldbus, dedicate to industrial automation. Chapter 6 discuss the Highway</p>	

	<p>Addressable Remote Transducer (HART), an open process control network protocol. Chapter 7 explain in detail the foundation of Fieldbus. Chapter 8 comprise the PROFIBUS, supports two types of devices: master device and slave device. Chapter 9 explain serial communication protocol MODBUS and MODBUS PLUS.</p>
12	<p>Topic:</p> <ol style="list-style-type: none"> <li><b>1 Data Communication</b> <ol style="list-style-type: none"> <li>1.1 Introduction</li> <li>1.2 Comparison between Digital and Analog Communication</li> <li>1.3 Data Communication</li> <li>1.4 Data Types</li> <li>1.5 Data Transfer Characteristics</li> <li>1.6 Data Flow Methods</li> <li>1.7 Transmission Modes</li> <li>1.8 Use of Modems</li> <li>1.9 Power Spectral Impairments</li> <li>1.10 Transmission Impairments</li> <li>1.11 Data Rate and Bandwidth Relationship</li> <li>1.12 Multiplexing</li> <li>1.13 Spread Spectrum</li> <li>1.14 Data Coding</li> </ol> </li> <li><b>2 Networking</b> <ol style="list-style-type: none"> <li>2.1 Introduction</li> <li>2.2 Characteristics</li> <li>2.3 Connection Types</li> <li>2.4 Data Communication Standards and Organizations</li> <li>2.5 Network Topology</li> <li>2.6 Network Applications</li> <li>2.7 Network Components</li> <li>2.8 Classification of Networks</li> <li>2.9 Interconnection of Networks</li> </ol> </li> <li><b>3 Network Models</b> <ol style="list-style-type: none"> <li>3.1 Introduction</li> <li>3.2 Three-Layer Model</li> </ol> </li> </ol>

	3.3 OSI Model
	3.4 TCP/IP Protocol Suite
<b>4</b>	<b>Network in Process Automation</b>
	4.1 Introduction
	4.2 Communication Hierarchy in Factory
	4.3 I/O Bus Networks
	4.4 OSI Reference Model
	4.5 Networking at I/O and Field Levels
	4.6 Networking at Control Levels
	4.7 Networking at Enterprise/Management Level
<b>5</b>	<b>Fieldbuses</b>
	5.1 What is Fieldbus?
	5.2 Topologies
	5.3 Terminators
	5.4 Fieldbus Benefits
<b>6</b>	<b>Highway Addressable Remote Transducer (HART)</b>
	6.1 Introduction
	6.2 Evolution and Adaptation of HART Protocol
	6.3 HART and Smart Devices
	6.4 HART Encoding and Waveform
	6.5 HART Character
	6.6 Addressing
	6.7 Arbitration
	6.8 Communication Modes
	6.9 HART Network
	6.10 Field Device Calibration
	6.11 HART Communication Layers
	6.12 Installation and Guidelines for HART Networks
	6.13 Device Descriptions
	6.14 Application in Control Systems
	6.15 Application in SCADA
	6.16 Benefits
<b>7</b>	<b>Foundation Fieldbus</b>

- 7.1 Introduction
- 7.2 Definition and Features
- 7.3 Foundation Fieldbus Data Types
- 7.4 Architecture
- 7.5 Standards
- 7.6 H1 Benefits
- 7.7 HSE Benefits
- 7.8 Communication Process
- 7.9 Technology of Foundation Fieldbus
- 7.10 Linking and Scheduling of Blocks
- 7.11 Device Information
- 7.12 Redundancy
- 7.13 HSE Device Types
- 7.14 System Configuration

## **8**

### **PROFIBUS**

- 8.1 Introduction
- 8.2 PROFIBUS Family
- 8.3 Transmission Technology
- 8.4 Communication Protocols
- 8.5 Device Classes
- 8.6 PROFIBUS in Automation
- 8.7 OSI Model of PROFIBUS Protocol Stack
- 8.8 PROFIBUS-DP Characteristics
- 8.9 PROFIBUS-PA Characteristics
- 8.10 Network Configuration
- 8.11 Bus Monitor
- 8.12 Time Stamp
- 8.13 Redundancy
- 8.14 PROFIsafe
- 8.15 PROFIdrive
- 8.16 PROFInet
- 8.17 PROFIBUS International
- 8.18 Foundation Fieldbus and PROFIBUS

	<p><b>9 MODBUS and MODBUS Plus</b></p> <p>9.1 Introduction</p> <p>9.2 Communication Stack</p> <p>9.3 Network Architecture</p> <p>9.4 Communication Transactions</p> <p>9.5 Protocol Description: PDU and ADU</p> <p>9.6 Transmission Modes</p> <p>9.7 Message Framing</p> <p>9.8 MODBUS TCP/IP</p> <p>9.9 Introduction to MODBUS Plus</p> <p>9.10 Message Frame</p> <p>9.11 Networking MODBS Plus</p>
13	<p>Main references:</p> <p>Fieldbus and Networking in Process Automation by Sunit Kumar Sen</p>
14	<p>Additional references:</p>