GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3730307

Semester – III
Industrial Data Networks

Type of course: Program Elective V

Prerequisite: Fundamentals of Analog and Digital Communication

Rationale: This course covers various communication standards including HART, Profibus, Foundation Fieldbus etc. used for industrial communication. It also covers PLC, DCS and SCADA briefly.

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	0	3	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
1	DATA NETWORK FUNDAMENTALS EIA 232 / EIA 485/ EIA 422 interface standards, ISO/OSI Reference model, Data link control protocol, Media access protocol:-Command/response, Token passing and CSMA/CD, TCP/IP, Bridges, Routers, Gateways, Standard ETHERNET configuration.	7
2	PLC, PLC PROGRAMMING & SCADA Evolutions of PLCs, Programmable controllers, Architecture, Comparative study of industrial PLCs. PLC Programming:- Ladder logic, Functional block programming, Sequential function chart, Instruction list and structured text programming. SCADA:- Remote terminal units, Master station, Communication architectures and open SCADA protocols.	8
3	DISTRIBUTED CONTROL SYSTEM & HART Evolution, Different architectures, Local control unit, Operator interface, Displays, Engineering interface, Factors to be considered in selecting DCS, Case studies in DCS. HART:- Introduction, Evolution of signal standard, HART communication protocol, Communication modes, HART networks, HART commands, HART applications. MODBUS protocol structure, Function codes.	8
4	PROFIBUS AND FF Fieldbus:- Introduction, General fieldbus architecture, Basic requirements of fieldbus standard, Fieldbus topology, Interoperability and interchangeability. Profibus:- Introduction, Profibus protocol stack, Profibus communication model,	7

	Communication objects, System operation and troubleshooting. Foundation fieldbus versus Profibus	
5	INTERFACE (AS-i), DEVICENET AND INDUSTRIAL ETHERNET AS interface, Devicenet, Industrial Ethernet, Introduction to OLE for process control, WSN technology, IOT, IIOT	**6**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**21**	**14**	**14**	**11**	

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.

Reference Books:

(1) G.K.McMillan, "Process/Industrial Instrument and Controls Handbook", McGraw-Hill handbook, Fifth Edition, New York, 1999.
(2) T.A. Hughes, "Programmable Logic Controllers: Resources for Measurements and Control Series", ISA Press, Fourth edition, 2005.
(3) J.Berge, "Field Buses for Process Control: Engineering, Operation, and Maintenance", ISA Press, 2004.
(4) S.Mackay, E.Wright, D.Reynders, and J.Park, "Practical Industrial Data Networks: Design, Installation and Troubleshooting", Newnes Publication, Elsevier, 2004.
(5) Alasdair Gilchrist," Industry 4.0:The Industrial Internet of Things", A press, 2016.
(6) Bela G. Liptak, "Process Software and Digital Network", CRC press

Course Outcomes: After the learning, students will able

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Understand the fundamentals of data networks used for industrial communication.	40
CO-2	Select and use most appropriate technologies and standards for a given application.	30
CO-3	Design and ensure that best practice is followed in installing and commissioning the data communications links to ensure they run fault-free.	30

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List of Open Source Software/learning website:

NPTEL