

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3152412

Semester – V

Subject Name: Industrial Communication System

Type of course: Professional Elective Course (Professional Elective – I)

Prerequisite: Basic Electronics, Analog and Digital Electronics

Rationale: This subject focuses on the study of different methods of data communication between different control devices and field instruments, and the study of the protocols used for data communication.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1	Basic of Communication System Communication, Communication systems, Modulation, Bandwidth Requirement. Channel Capacity, Baud Rate, Data Rate.	2
2	Modulation: Theory of Amplitude Modulation, Frequency spectrum of AM wave, Representation of AM, Power Relation in the AM wave. Theory of Frequency Modulation, Mathematical Representation of FM, Frequency spectrum of FM wave. Theory of Phase Modulation, Comparison of different modulations Modulation for Digital signal: Introduction, modulation circuit, demodulation circuit, ASK, FSK, PSK, PWM, PAM, PPM.	8
3	Basic Principles of Data Communication Bit, Bytes and Characters, Communication principle, Communication modes, Synchronous and asynchronous system, Error detection, Transmission Characteristics, Data coding, UART.	3
4	Serial Communication Standard Serial data communication interface standards, Balanced and unbalanced transmission lines, RS 232 interface standard, Troubleshooting serial data communication circuits, Test equipment, RS 422 Standard, RS 485 Standard, Troubleshooting and testing with RS 485, 20 mA Current loop, GPIB ,USB.	8
5	Cabling and Interference Cabling: Introduction, Copper based cable, Coaxial cable, Twisted pair cable, Fiber optic cable. Noise and Interference : Definition of noise, External and Internal noise, Noise calculation, Noise Figure, Noise Temperature, , Frequency analysis of noise, Source of electrical noise, Electrical coupling of noise, Shielding, Cable ducting, Cable spacing, Earthing and grounding requirement, Suppression techniques.	5
6	Industrial Protocols Introduction to protocols, Modbus protocol, HART, Fieldbus and Device Net system TCP / IP	10

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7	LAN and Wireless Communication Systems Overview of class of network, Network Topologies, Transmission Techniques, Ethernet. Wireless LAN using CSMA/CA, Cellular Digital Packet Network, Satellite communication.	3
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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	25	25	10	10	0

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	Electronic Communication Systems, Kennedy and Devis
2	Practical Data Communications for Instrumentation and Control, John Park
3	Introduction to Data and Network Communication, Michael A. Miller
4	Instrument Engineers Handbook Vol. III, B.G.Liptak

Course Outcomes:

At the end of the course, student should be able to:

Sr. No.	CO statement	Topics Mapped	Marks % weightage
CO-1	Illustrate behavior of various analog and digital modulation and demodulation technique.	1,2	25
CO-2	outline basic, data and wireless communication systems.	3,7	15
CO-3	identify the different types of Cables and effect of noise.	5	10
CO-4	interpret Industrial protocols used for communication.	6	25
CO-5	compare serial communication standards	4	25

Suggested List of Experiments / Open Ended Problems:

1. To study Amplitude Modulation and Frequency Modulation.
2. To study and simulate Pulse Width Modulation.
3. To study digital communication using ASK, FSK and PSK.
4. To study RS-232, RS-485 and RJ-45 communication standards.
5. To study types of Cables and Interference.
6. To study Modbus Protocol.
7. To study HART Protocol.
8. To study CANBUS, Device Net and SDS system.
9. To study network topologies and Ethernet.
10. To study mobile communication and satellite communication.

Major Equipment:

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Signal communication trainers. Data communication Protocol trainers.

List of Open Source Software/learning website:

- **Learning website:**
 - <http://nptel.iitm.ac.in/courses.php>
 - <http://ocw.mit.edu>
 - <http://www.electrical-engineering-portal.com>
 - <http://en.wikipedia.org>
 - <https://www.anlog.com>
 - <https://www.protocols.com>