GUJARAT TECHNOLOGICAL UNIVERSITY

BE - Semester 6
Minor Degree : Electrical and Computer
Subject Code : 116AK02
Subject Name : Data Communication for Electrical Systems

Type of course : Minor Degree Course

Prerequisite : Knowledge of basics of power system and its control.

Objective :

The objective of this course is to give an overview of technologies and concepts used for communication and control of power systems in a wide sense, including generation, transmission and distribution of electric power.

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	00	30	00	100

Sr. No.	Content	Total Hrs.
1	**DATA AND SIGNALS :** Data –types, Signal – types, Periodic & Non Periodic Signals, Analog Signal, Characteristics of Analog Signal, Time & Frequency Domain Representation of a signal, Digital Signal and its characteristics, Level and bit length, Bit Rate and Baud Rate, Types of Channel, Lowpass Channel, Bandpass Channel, Transmission of Digital signal, Channel bandwidth, Maximum data rate of a channel.	05
2	**SIGNAL ENCODING DECODING :** Introduction to Signal Encoding, Digital Data to Digital Signal, Line Encoding, Unipolar – NRZ,.Polar-NRZ, NRZ-L, NRZ-I, RZ, Biphase, Bipolar - AMI, Analog data to analog signal conversion, Modulation, Types of Modulation, AM, FM, PM, Digital to Analog signal conversion, Analog to Digtal conversion.	07
3	**ERROR DETECTION AND CORRECTION :** Error Classification, Types of errors, Redundancy, Detection versus correction, Hamming distance, Cyclic Redundancy Check.	04
4	**DATA TRANSMISSION :** Transmission Modes & Types, Parallel Transmission, Serial Transmission, Categories of Transmission Medium, Twisted Pair, Power Line Carrier Communication (PLCC), PLCC Systems and components, PLCC coupling scheme, PLCC application, Optical Fiber, Structure of an Fiber Optic Cable, Propagation Modes of Fiber Optic Cable, Calculation of Number of Modes in a Fiber	08

5	**WIRELESS COMMUNICATION MEDIA :** Wireless Transmission Medium, Propagation Method of wireless signals, Types of wireless transmission, Radio waves, Microwaves, Infrared, Satellite communication, Comparison between wired and wireless media	**08**
6.	**DATA NETWORK IN ELECTRICAL SYSTEMS :** Fundamental of SCADA, Building blocks of SCADA systems, Remote terminal unit (RTU), Evolution of RTUs, Components of RTU, Communication subsystem, Logic subsystem, Termination subsystem, Testing and human-machine interface (HMI) subsystem, Power supplies, Advanced RTU functionalities, Intelligent electronic devices (IEDs)	**10**

Suggested Specification table with Marks (Theory) :

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**25**	**30**	**15**	**5**	**5**

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 the above table.

Reference Books :

1. Shahidehpour, Mohammad, and Yaoyu Wang. "Communication and control in electric power systems: applications of parallel and distributed processing", John Wiley & Sons, 2004.
2. Matin, Mohammad A., "Communication Systems for electrical engineers", Springer International Publishing, 2018.
3. Thomas, Mini S., and John Douglas McDonald, "Power system SCADA and smart grids." CRC press, 2017.

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Course Outcomes :

Sr. No.	CO STATEMENT	Bloom's taxonomy level	Marks % weightage
CO1	To introduce the concept of data, signal and data communication with its protocols.	**Remember L1 , Understand L2, Evaluate L5,**	**10 %**
CO2	To learn the process of signal conversion and encoding.	**Remember L1 , Understand L2, Evaluate L5,**	**20 %**
CO3	To understand the process of signal transmission.	**Remember L1 , Understand L2, Evaluate L5**	**20 %**
CO4	To understand the signal conversions and encoding.	**Remember L1 , Understand L2, Evaluate L5 Create L6**	**20 %**
CO5	To understand SCADA and other data acquisition system with respect to Electrical applications.	**Remember L1 , Understand L2, Evaluate L5 Create L6**	**30 %**

Suggestive List of Experiments :

1. To study measurement devices in power system- Current Transformer and Hall Effect Transformer
2. To study measurement devices in power system- Potential Transformer and CVT
3. To simulate and understand Analog to Digital and Digital to Analog conversion.
4. To study various methods of signal encoding and decoding.
5. To study various modulation techniques in communication system.
6. To simulate and check time domain to frequency domain conversion.
7. To study Remote Terminal Unit for power system.
8. To study the SCADA system for electrical data acquisition and control

List of Software/learning website : - MATLAB