GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161715

INDUSTRIAL DATA COMMUNICATION AND DISTRIBUTED CONTROL SYSTEM

6th Semester

Type of course: Professional Elective Course

Prerequisite: Sensor/ transducer, field transmitters, converters, final control element, basic instrumentation symbols, process control modes and techniques, PLC architecture

Rationale: DCS systems are used extensively in industries. In such computer based automation system; information, communication, and networking technologies have become integral part. So, it is necessary to know hardware interfacing with software driven automation system. This course gives an idea of general structure of DCS and communication protocol system, functional elements, data links, software and algorithms, communication and control aspects of modern plant automation system.

Teaching and Examination Scheme:

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

Content:

S. N.	Content	Total Hrs	% Weightage
1	**DCS – Introduction & Development History** Early Computer systems: Direct digital control, Centralized computer system, Distributed control Hierarchical Control: Hierarchical computer system for a large manufacturing process, overall task, detail task listing, lower level computer task, higher level computer task	04	10
2	**DCS-Basic packages** Analog control, direct Digital control, Distributed process control, DCS configurations Local Control Units (Relay rack mounted equipment) :Dedicated card controllers, Unit operations controllers, Multiplexers- Design, system configuration, Remote stations, Super-commutation and sub-commutation - Power supplies, - Input/ Output, - Controller file The control console equipment: - Video display, - key board, - peripheral	10	24

	devices, - Displays: Group displays, Overview displays, Detail displays, Graphic displays, Trend displays, Alarm reporting, generation and acceptance Communication between components: Data highway designs, highway compatibility, Network access protocols, Network topologies, Maintenance considerations- Reliability, availability, Single loop integrity, backup systems, Redundant and Fault tolerant systems		
3	**Software configuration** Operating system configuration, - Controller function configuration, - Algorithm libraries, Process control programming: - Types of program, Features of process control programs, The executive program, Programming language for process control Algorithms- The position algorithm, Velocity algorithm, cascade and ratio control, Feed-forward, Other algorithm like Dead band control, emergency response, error squared	06	16
4	**System Integration with PLC and computers** Supervisory computer functions: Supervisory control and optimization, production monitoring and control, on-line information system DCS and supervisory computer displays- Display access method, display features, alarm access architecture, voice input machine interface Man Machine Interface – Sequencing, Supervisory control Computer interface with DCS- Hardware: Gateway, Interface with PLC, Interface with Direct I/O, Network linkages, Links between networks	04	12
5	**Field buses, MAP/TOP, Network protocol** Computer integrated processing, communication hierarchy Industrial communication systems:Management system – MAP/TOP protocol Field buses- fieldbus standardization, Smart transmitters- Rackbus: Bus access method, transmitter, gateways, availability MODBUS - bus access method, application services, transmission modes, function, acceptance PROFIBUS- bus access method, data link services, application services, acceptance FIPBUS - bus access method, other features, acceptance International FIELDBUS standard	10	24
6	**Typical DCS used in Industry.** Honeywell PlantScape system, Foxboro I/A series DCS, Delta system, Citect, Wonderware	04	14

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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
7	**14**	**21**	**14**	**14**	**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. Process Control- Instrument Engineers Handbook by Bela G. Liptak, Chilton book co.
2. Overview of Industrial Process Automation by KLS Sharma, Elsevier pub.
3. Practical Distributed Control Systems (DCS) for engineers and technicians by IDC Technologies
4. Distributed Computer Control Systems in Industrial Autoation by D. Popovic and V. Bhatkar, Marcel Dekker

Course Outcomes: Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Analyze current philosophy, technology, terminology, and practices used in automation industries..	
CO-2	Evaluate computer based automation system used in industries ranging from discrete, continuous process to hybrid processes.	
CO-3	Identify hardware and software for modern automation system required for industrial application.	
CO-4	Apply relevant concept to configure hardware with software for automation application	
CO-5	Understand various communication protocols	

List of Experiments:

1. DCS-Flow-sheet symbol (ch. 7.11- B.G. Liptak –II – Process control)
2. Study of various DCS display options
3. DCS cost estimation procedure (ch. 7.8- B.G. Liptak –II – Process control)
4. Study of stand-alone single loop PID controller
5. Interfacing of different devices using RS-232, RS-485 and RS-422 communication
6. Study of important features of SCADA software package
7. Study of different type of animations used in SCADA software
8. Development of GUI using different type of scripting on SCADA software
9. Interfacing of PLC with SCADA software package
10. Communication of SCADA software with Ms-excel/SQL/MS-Access
11. Interfacing of I/O modules with SCADA/ DCS package

12. Study of LAN of computer lab (to understand the network topology, network access protocol, data highway option, Ethernet, etc.)

Major Equipment:

Computers, I/O modules, PLC, SCADA software, DCS set up, PID Controller, etc.

List of Open Source Software/learning website:

http://ial-coep.vlabs.ac.in/

http://www.idc-online.com

http://www.isa.org

http://www.controleng.com/

http://literature.rockwellautomation.com/

http://www.automation.siemens.com/

http://nptel.ac.in/video.php