SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Instituion)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRONICS AND INSTRUMENTATION ENGINEERING

QUESTION BANK

II - SEMESTER

M.E. CONTROL AND INSTRUMENTATION

1913202 – INDUSTRIAL AUTOMATION

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UNIT I - INTRODUCTION			
Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: Modbus & Profibus.			
PART-A			
Q. No	**Questions**	**BT Level**	**Competence**
1.	Define Automation.	BTL 1	Remember
2.	Mention the advantages of Automation.	BTL 2	Understand
3.	Mention the disadvantages of Automation.	BTL 2	Understand
4.	Classify automated manufacturing systems.	BTL 3	Apply
5.	What is a PLC?	BTL 1	Remember
6.	What are the main advantages of PLC over other controllers?	BTL 2	Understand
7.	What are the major areas of application of PLC?	BTL 3	Apply
8.	What are the advantages of PLC over Relays?	BTL 2	Understand
9.	Explain the classification of PLC.	BTL 3	Apply
10.	What is the difference between a PLC and a computer?	BTL 4	Analyze
11.	Compare PLC and SCADA.	BTL 4	Analyze
12.	Define SCADA.	BTL 1	Remember
13.	List the functionalities of SCADA.	BTL 1	Remember
14.	Propose some of the areas where SCADA can be applied.	BTL 6	create
15.	List the potential benefits of SCADA.	BTL 1	Remember
16.	Identify the protocols used in SCADA communication.	BTL 3	Apply
17.	Point out the features of MODBUS communications.	BTL 4	Analyze
18.	Classify the types of PROFIBUS.	BTL 3	Apply
19.	Summarize the features of PROFIBUS	BTL 2	Understand
20.	List any two applications of MODBUS and PROFIBUS.	BTL 2	Understand
PART-B			
1.	What is automation? Explain briefly about three elements of Automated system.**(13)**	BTL 1	Remember
2.	Discuss briefly about the requirement of automation systems. **(13)**	BTL 2	Understand
3.	Explain briefly about the Industrial Automation system with an example. **(13)**	BTL 3	Apply
4.	Analyze and explain the reasons why companies automate their operations? **(13)**	BTL 4	Analyze
5.	What is meant by Computer Integrated Manufacturing? Explain in detail with an example. **(13)**	BTL 1	Remember
6.	What is programmable automation and discuss its features? **(13)**	BTL 2	Understand
7.	What is fixed and flexible automation and mention its features? **(13)**	BTL 2	Understand
8.	Discuss in detail about PLC based control of process with example. **(13)**	BTL 3	Apply
9.	**(i).** Explain how PLC is categorized depending on its size and also discuss the applications? **(7)**	BTL 4	Analyze
	(ii) Differentiate PLC and Conventional relay based logic system. **(6)**		
10.	Describe about the hardware and software architecture of SCADA. **(13)**	BTL 1	Remember
11.	Discuss in detail about communication architecture and SCADA protocols. **(13)**	BTL 2	Understand

12.	**(i).**	Explain the role of common system components of SCADA. **(8)**	BTL 3	Apply
	(ii)	Explain the functions performed by the basic elements of DAQ system.**(5)**		
13.	Discus about the MODBUS protocol with neat diagram.**(13)**		BTL 2	Understand
14.	**(i).**	Describe briefly about architecture of Profibus. **(8)**	BTL 1	Remember
	(ii).	Write short notes on communication protocol of Profibus**. (5)**	BTL 1	Remember
PART-C				
1.	Generalize three basic types of automation and explain about each type in detail. **(15)**		BTL 6	create
2.	Assess the five levels of automation in a production plant and explain in detail. **(15)**		BTL 5	Evaluate
3.	**(i)**	Summarize the physical hardware differences between PLC and personal computers. **(6)**	BTL 5	Evaluate
	(ii)	With a neat diagram explain the principle of operation PLC with example. **(9)**		
4.	Formulate various modules for a SCADA system and explain with neat schematic diagram. **(15)**		BTL 6	create

UNIT II - AUTOMATION COMPONENTS

Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

PART-A

Q.No	Questions	BT Level	Competence
1.	Classify the different temperature measurement types using change in physical properties.	BTL 3	Apply
2.	Sketch the thermoelectric characteristics of thermocouple.	BTL 6	Create
3.	Analyze the need for cold junction compensation in temperature measurement.	BTL 4	Analyze
4.	Mention the different units used for measurement of pressure.	BTL 2	Understand
5.	Name the transducers used for measuring low pressure.	BTL 1	Remember
6.	How elastic materials are used for force measurement?	BTL 4	Analyze
7.	Identify the factors affecting the accuracy of force measurement.	BTL 3	Apply
8.	Illustrate the factors to be considered while selecting a flow meter.	BTL 3	Apply
9.	Name the different types of mass flow meter.	BTL 1	Remember
10.	State the limitations of float type level indications.	BTL 1	Remember
11.	Generalize the advantages of capacitance level measurement.	BTL 5	Evaluate
12.	Define fluidity and relative humidity.	BTL 1	Remember
13.	Assess the need to measure pH in a solution.	BTL 5	Evaluate
14.	List the features of DIAC.	BTL 2	Understand
15.	Define the term pinch off voltage of MOSFET.	BTL 1	Remember
16.	Compare the merits and demerits of IGBT and MOSFET.	BTL 4	Analyze
17.	Draw TRIAC characteristics.	BTL 6	Create
18.	Why IGBT is becoming popular in applications?	BTL 4	Analyze
19.	Why MOSFETs are preferred for high frequency applications?	BTL 4	Analyze
20.	Compare AC and DC servo motors.	BTL 4	Analyze

PART - B				
1.	Illustrate the different principles of temperature measurement with necessary specification. **(13)**		BTL 2	Understand
2.	Describe the methods of pressure measurement using resistive type pressure transducers. **(13)**		BTL 1	Remember
3.	Describe the pressure measurement process using the following: **(i)** Bourdon tubes. **(4)** **(ii)** Bellows. **(4)** (iii) Diaphragms. **(5)**		BTL 2	Understand
4.	Explain the principle and construction of any one method of force measurement. **(13)**		BTL 3	Apply
5.	Briefly describe in detail about displacement transducer with neat diagram. **(13)**		BTL 1	Remember
6.	Briefly describe the working of different speed measurement methods.**(13)**		BTL 1	Remember
7.	Explain the construction and working of DC and AC tachogenerator with diagram and mention its advantages and disadvantages. **(13)**		BTL 3	Apply
8.	Distinguish variable head and variable area flow meters. Explain the working principle of any one type of variable head flow meter with neat sketch. **(13)**		BTL 4	Analyze
9.	**(i).**	Explain with neat sketch the construction and working of rotameter. **(9)**	BTL 4	Analyze
	(ii).	Discuss the advantages and disadvantages of rotameter. **(4)**		
10.	Describe briefly about the different methods of level measurement. **(13)**		BTL 1	Remember
11.	Describe the different methods used for measurement of Humidity. **(13)**		BTL 3	Apply
12.	Examine the structure and different modes of operation with the characteristics of TRIAC. **(13)**		BTL 4	Analyze
13.	Draw and analyze the static I-V, transfer and turn –on and turn–off characteristics of IGBT circuit. **(13)**		BTL 4	Analyze
14.	Explain the structure and different modes of operation of TRIAC. Also draw its characteristics. **(13)**		BTL 1	Remember
PART-C				
1.	Formulate the principles used for the measurement of humidity and also explain about the design and working of any one type of hygrometer with neat sketch. **(15)**		BTL 6	Create
2.	**(i).**	Define the term pH. Evaluate the features of various types of electrodes used in pH measurements. **(7)**	BTL 5	Evaluate
	(ii).	Design a glass electrode based pH measurement system and explain its working. **(8)**		
3.	**(i).**	Design a driver circuit for power MOSFET and explain its working.**(7)**	BTL 6	Create
	(ii).	Draw and explain steady-state and switching characteristics of power MOSFETS**. (8)**		
4.	**(i)**	Generalize the features of various types of industrial thermocouples with the information like materials used, temperature range, accuracy and reliability. **(8)**	BTL 6	Create
	(ii)	Design a commercial circuit for the cold junction compensation of thermocouple and explain how the difference in temperature is compensated**. (7)**		

UNIT - III COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS			
Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation.			
PART-A			
Q. No	**Questions**	**BT Level**	**Competence**
1.	Mention some applications of digital computer.	BTL 3	Apply
2.	What is a modem?	BTL 1	Remember
3.	Assess the role of computers in process control.	BTL 5	Evaluate
4.	Name some functions of computer aided process control systems.	BTL 2	Understand
5.	Draw the block diagram of a typical computer aided process control system.	BTL 2	Understand
6.	Classify the computer aided industrial processes based on its architecture.	BTL 3	Apply
7.	What are the different levels of tasks of computer control system?	BTL 2	Understand
8.	What is meant by MMI?	BTL 1	Remember
9.	List any two reasons for errors in MMI.	BTL 3	Apply
10.	What is RTC?	BTL 1	Remember
11.	Analyze the necessity for data transfer in process control applications.	BTL 4	Analyze
12.	Mention the different categories of transmission techniques.	BTL 2	Understand
13.	What are the three major parts of computer programs?	BTL 1	Remember
14.	List the functions performed by system software.	BTL 3	Apply
15.	Point out the features of process control software.	BTL 4	Analyze
16.	Mention the applications of signal conditioning.	BTL 3	Apply
17.	Summarize the benefits of computers in measurement and control.	BTL 4	Analyze
18.	Name the functions performed by application program.	BTL 3	Apply
19.	List the layers of OSI model architecture.	BTL 1	Remember
20.	Differentiate TDM and FDM.	BTL 4	Analyze
PART-B			
1.	Illustrate the role and elements of computer-aided measurements and control with an example.**(13)**	BTL 3	Apply
2.	With neat diagram explain the block diagram of computer aided process control system. **(13)**	BTL 2	Understand
3.	Briefly discuss the features of distributed computer control systems. **(13)**	BTL 2	Understand
4.	Describe the famous 5 levels of automation hierarchy of computer-aided process control system. **(13)**	BTL 3	Apply
5.	What is MMI? Analyze the role and importance of MMI in process industry. **(13)**	BTL 4	Analyze
6.	With neat sketch, explain the organization of general purpose computer with various peripheral devices. **(13)**	BTL 1	Remember
7.	Explain with a neat sketch the construction and working of **(i)** Analog to digital conversion system (ADC). **(ii)** Digital to analog conversion system (DAC). **(13)**	BTL 1	Remember
8.	Explain the concept of serial and parallel transmission techniques used for communication between two intelligent devices. **(13)**	BTL 3	Apply
9.	Illustrate briefly about bus interfaces used in IBM-compatible PCs. **(13)**	BTL 2	Understand

10.	What is Multiplexing? Discuss briefly about various multiplexing techniques used in communication channels. **(13)**		BTL 2	Understand
11.	**(i)**	Explain briefly about MAP and TOP protocols used in industrial communication systems. **(9)**	BTL 3	Apply
	(ii)	Briefly discuss the advantages and applications of field-bus.**(4)**		
12.	Explain in detail about types of computer control process software and its features. **(13)**		BTL 1	Remember
13.	Draw and explain the block diagram of computer based Data Acquisition (DAQ) system. **(13)**		BTL 2	Understand
14.	Explain about the role of IOT in process industries with an example.**(13)**		BTL 4	Analyze

PART-C

1.	Propose a Hot-air blower system and elaborate how a computer aided control can be implemented with neat block diagram. **(15)**	BTL 6	Create
2.	Propose an architecture for a computer-aided control system that can be used in process industries with neat sketch. **(15)**	BTL 6	Create
3.	Evaluate the performances of various types of standard interfaces used in digital computer for capturing plant process data. **(15)**	BTL 5	Evaluate
4.	With neat sketch explain the ISO reference model for communication. Also discuss about various topologies used for data transmission.**(15)**	BTL 5	Evaluate

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS

Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

PART-A

Q.No	Questions	BT Level	Competence
1.	List any four PLC input devices	BTL 1	Remember
2.	List out some analog I/O in PLC.	BTL 2	Understand
3.	Define the term I/O modules.	BTL 1	Remember
4.	Define scan time in PLC.	BTL 1	Remember
5.	Draw the PLC ladder diagram for NAND gate.	BTL 6	Create
6.	Sketch the PLC ladder diagram for Ex-NOR gate.	BTL 6	Create
7.	Define counters in PLC.	BTL 1	Remember
8.	What is Sequential flow chart?	BTL 2	Understand
9.	What is functional block diagram?	BTL 2	Understand
10.	Analyze the use of timers in PLC.	BTL4	Analyze
11.	Design a ladder logic diagram for single input timer.	BTL 6	Create
12.	Differentiate timers and counters.	BTL 3	Apply
13.	What is ladder diagram?	BTL 1	Remember
14.	Identify the factors to be considered for the use of PLC programming.	BTL 3	Apply
15.	Name the types of control equipment.	BTL 1	Remember
16.	What is common language structure?	BTL 2	Understand
17.	When is the output of PLC counter energized?	BTL 3	Apply
18.	Point out the characteristics helpful in selection of PLCs.	BTL4	Analyze
19.	List the techniques to be observed in installation of PLCs.	BTL 3	Apply
20.	Point out the applications of PLC in process industries.	BTL4	Analyze

PART-B				
1.	Describe about various hardware components of PLC with neat diagram**. (13)**		BTL 3	Apply
2.	Explain about the architecture of PLC with neat diagram. **(13)**		BTL 3	Apply
3.	Discuss the basic function of discrete I/O modules involved in PLC. **(13)**		BTL 2	Understand
4.	Discuss the basic function of analog I/O modules involved in PLC. **(13)**		BTL 2	Understand
5.	Illustrate the basic operation of Ladder logic with suitable example. **(13)**		BTL 3	Apply
6.	Explain the basic operation of Sequential function chart with suitable example. **(13)**		BTL 4	Analyze
7.	**(i)**	Describe the operation of Functional block programming. **(7)**	BTL 1	Remember
	(ii)	Describe the operation of Instruction list and Structured text programming. **(6)**		
8.	**(i)**	Explain ON DELAY timer with anyone example. **(8)**	BTL 3	Apply
	(ii)	What is program scans and how it operates? **(5)**		
9.	**(i)**	Develop ladder diagram for controlling the level of liquid in a tank between upper and lower limits. **(7)**	BTL 6	Create
	(ii)	Sketch and explain the timing diagram of OFF DELAY timer. **(6)**		
10.	Discuss in detail about PLC communications and networking. **(13)**		BTL 2	Understand
11.	Analyze briefly the benefits of using PLCs for industrial applications also discuss about various applications of PLCs. **(13)**		BTL 4	Analyze
12.	Explain how PLC programming is done to achieve a particular control of a plant parameter. **(13)**		BTL 4	Analyze
13.	With neat sketch, explain the construction and working of a programmable logic controller used in process industries. **(13)**		BTL 3	Apply
14.	Design a PLC program to control one way traffic lights for a transition from red to green to amber. **(13)**		BTL 6	Create
PART-C				
1.	Develop a PLC program to count the number of trucks entering and leaving a parking garage and turn ON the pilot light once the garage is full. **(15)**		BTL 6	Create
2.	Evaluate the system characteristics that need to be analyzed for selection of PLC. **(15)**		BTL 5	Evaluate
3.	Formulate the safety rules and practices, governing proper use of electrical control equipment to be observed for using PLCs. **(15)**		BTL 6	Create
4.	Develop ladder diagram for the following oven control applications. **(a).** Turn ON the heating element and cooling fan simultaneously for heating. **(b)**. Turn OFF the heating element when oven is turned OFF and OFF DELAY timer for 10secs starts counting down and then the cooling fan is turned OFF**. (15)**		BTL 6	Create

UNIT V DISTRIBUTED CONTROL SYSTEM			
Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS, Commercial DCS.			
PART-A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	Define Distributed Control System (DCS)?	BTL 1	Remember
2.	List the functions performed by DCS.	BTL 1	Remember
3.	Classify the types of displays used in DCS.	BTL 4	Analyze
4.	Assess the necessity of software configuration in DCS.	BTL 5	Evaluate
5.	Point out the advantages of using fiber optics in data highways.	BTL 4	Analyze
6.	Identify the protocols used in DCS communication.	BTL 1	Remember
7.	Summarize few tasks performed by supervisory computer.	BTL 2	Understand
8.	Categorize the functions performed by supervisory control.	BTL 2	Understand
9.	Illustrate the functions performed by on-line information system.	BTL 3	Apply
10.	Recommend few algorithms suitable for supervisory control in DCS.	BTL 5	Evaluate
11.	What is meant by MMI?	BTL 1	Remember
12.	Mention the features of DCS.	BTL 2	Understand
13.	Illustrate the advantages of using DCS in process control applications.	BTL 3	Apply
14.	What is meant by LCU?	BTL 1	Remember
15.	Deduce the role of communication interface in DCS.	BTL 5	Evaluate
16.	Compare individual, centralized and distributive control systems.	BTL 4	Analyze
17.	Analyze the major architectural parameters to be considered for designing a controller for various industrial control applications.	BTL 4	Analyze
18.	Identify the need for interface in DCS	BTL 5	Evaluate
19.	Compare the features of Coaxial and fiber-optic cable	BTL 4	Analyze
20.	Evaluate the features of shared communication facility used in DCS.	BTL 2	Understand
PART-B			
1.	Discuss in detail about the evolution of DCS with its functionality. **(13)**	BTL 2	Understand
2.	Draw the schematic of a basic Distributed Control System (DCS) and explain. **(13)**	BTL 1	Remember
3.	Explain briefly about various functional blocks of DCS. **(13)**	BTL 4	Analyze
4.	Summarize the types of configurations that are used in DCS software and explain each configuration in detail. **(13)**	BTL 5	Evaluate
5.	Explain about the libraries and its associated algorithms used for various control in DCS. **(13)**	BTL 4	Analyze
6.	Decribe in detail about International field bus standards used for communication in process industries. **(13)**	BTL 1	Remember
7.	Analyze the advantages and disadvantages of Network access protocols used in networking of DCS for communication. **(13)**	BTL 4	Analyze
8.	Illustrate briefly about the supervisory tasks performed by DCS system. **(13)**	BTL 3	Apply
9.	Discuss about (i). Production monitoring and control. **(7)** (ii). On-line information system. **(6)**	BTL 2	Understand
10.	Identify the algorithms used in supervisory control and describe its functionalities. **(13)**	BTL 1	Remember

11.	Elaborate briefly about integration of DCS with PLCs and Computers. **(13)**	BTL 3	Apply
12.	Describe in detail about Man-Machine Interface (MMI) **(13)**	BTL 1	Remember
13.	Outline the features of DCS and mention the advantages of using DCS in process industry. **(13)**	BTL 4	Analyze
14.	Shared communication plays a critical role in DCS. Is it True? Justify. **(13)**	BTL 2	Understand
	PART-C		
1.	Prepare the types of displays that can be achieved using DCS for efficient monitoring of plant parameters and explain its features and functionalities. **(15)**	BTL 6	Create
2.	Compare the features of Data highways used in DCS to perform control action in a Plant. **(15)**	BTL 5	Evaluate
3.	Discuss in brief about the network access protocol that are used as communication methods for distributed control highways. **(15)**	BTL 6	Create
4.	Evaluate the methods used for performance optimization of supervisory control and discuss the functionality of supervisory control. **(15)**	BTL 5	Evaluate