INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

ELECTRCIAL AND ELECTRONICS ENGINEERING

QUESTION BANK

Course Name	**:**	**INDUSTRIAL AUTOMATION AND CONTROL**
Course Code	**:**	**AEE511**
Class	**:**	**B. Tech V Semester**
Branch	**:**	**Electrical and Electronics Engineering**
Year	**:**	**2018 – 2019**
Course Coordinator	**:**	**Dr.V.Chandra Jagan Mohan, Associate Professor, EEE**
Course Faculty	**:**	**Dr.V.Chandra Jagan Mohan, Associate Professor, EEE** **Dr. M.Pala Prasad Reddy, Associate Professor , EEE**

OBJECTIVES:

I	Learn the fundamental concepts about introduction to industrial automation and control and devices.
II	Study the performance of each system in detail along with practical case studies.
III	Develop various types of industrial automation and control and devices.
IV	Understand the process control of PLC automation.

COURSE OBJECTIVES:

The course should enable the students to:

I	Define the basic objectives of a manufacturing industry and explain the different measuring systems.
II	Examine the different methods for controlling an industrial process.
III	Describe the functioning and programming of Programmable logic controllers (PLC's).
IV	Illustrate the importance of CNC machines and uses of actuators in a process control system.
V	Explain the operation and application of Electrical machine drives.

COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

AEE511.01	Describe the various elements of an Industrial Automation Systems and how they are organized hierarchically in levels.
AEE511.02	Define the different terms used for characterizing the performance of an instrument/ measurement system
AEE511.03	Name the different methods of measuring temperature, pressure, force, displacement and speed.
AEE511.04	Study the signal conditioning circuits, different types of errors
AEE511.05	Write the input-output relationship of a P-I-D controller
AEE511.06	Justify the use of feed forward and ratio control schemes.
AEE511.07	Explain the two schemes for predictive control Suggest a suitable compensation scheme for control of a process with inverse response
AEE511.08	Define Sequence and Logic Control and Name the major functions performed by a PLC
AEE511.09	Describe the structure of a PLC Program and the execution of a PLC Program
AEE511.10	Describe motivations for formal modelling in the design of sequence control programs for an industrial control problem.
AEE511.11	Describe the physical organization of hardware in the PLC
AEE511.12	Define Numerical Control and describe its advantages and disadvantages
AEE511.13	Name the types of control valves and sketch their ideal flow characteristics
AEE511.14	Describe the principles of operation of hydraulic systems and understand its advantages
AEE511.15	Describe pressure switches, as well as pressure and flow gauges used in hydraulic systems
AEE511.16	Demonstrate energy saving with variable speed drive method of flow control compared to throttling
AEE511.17	Explain with schematic diagrams, open loop and closed loop control schemes used for step motors
AEE511.18	Describe the operational features of dc motor drives, Induction motor drives, BLDC motor drives for Electrical actuators.

UNIT-I				
INTRODUCTION TO INDUSTRIAL AUTOMATION AND CONTROL				
Part –A (SHORT ANSWER QUESTIONS)				
S. No	**Question**	**Blooms Taxonomy Level**	**Course Outcomes**	**CLO CODE**
1	Define the terms automation and control.	Remember	CO1	AEE511.01
2	List the types of production systems and automation systems.	Remember	CO1	AEE511.01
3	Draw the automation pyramid and name the each layer of automation pyramid.	Remember	CO1	AEE511.01
4	State three major functions of a production control system.	Understand	CO1	AEE511.03
5	State three major functions of supervisory control.	Remember	CO1	AEE511.03
6	Draw the block diagram of a sensory system.	Remember	CO1	AEE511.04
7	Define linearity and sensitivity of a measuring instrument.	Remember	CO1	AEE511.03
8	Define accuracy and precision of a measuring instrument.	Remember	CO1	AEE511.03
9	Define range and resolution and of a measuring instrument.	Understand	CO1	AEE511.03
10	Name different devices used for measurement of temperature and pressure.	Remember	CO1	AEE511.02
11	Name different methods for pressure measurement using elastic transducers.	Understand	CO1	AEE511.02
12	Define gauge factor of a strain gauge.	Understand	CO1	AEE511.02
13	Name different methods for force measurement with strain gauges.	Understand	CO1	AEE511.03
14	Name two methods of noncontact type speed sensing.	Remember	CO1	AEE511.03
15	Define CMRR of an operational amplifier.	Remember	CO1	AEE511.04
PART – B (LONG ANSWER QUESTIONS)				
1	State the main objectives of a modern industry (at least five) and explain the role of automation in helping achieve them.	Understand	CO2	AEE511.02
2	Describe the architecture of industrial automation with automation pyramid.	Understand	CO2	AEE511.01
3	Distinguish between the principles of operation of RTD and Thermistor for measuring the temperature of a process.	Understand	CO2	AEE511.03
4	Explain the construction and operation of Resistance Temperature Detector (RTD).	Understand	CO2	AEE511.03
5	Explain the construction and operating principle of thermo couple and list the materials used for design of thermocouple.	Understand	CO2	AEE511.03
6	Explain the construction and principle of operation of a Bourdon tube pressure gage.	Understand	CO2	AEE511.03
7	Explain the operation of Load cell and Proving ring for measurement of strain.	Understand	CO2	AEE511.04
8	Explain how the effect of temperature variation can be compensated in a strain gage bridge?	Understand	CO2	AEE511.04
9	Describe with neat sketch the construction, operation and characteristics of LVDT .	Understand	CO2	AEE511.03
10	Explain the principles of operation of inductive and capacitive types of proximity sensors.	Understand	CO2	AEE511.04
11	Sketch and explain the principle of operation of a optical type displacement sensor.	Understand	CO2	AEE511.04

12	Identify the different building blocks of a measuring system and explain the function of each block.	Understand	CO2	AEE511.01
13	Explain the advantage of using push-pull configuration in unbalanced A.C. and D.C. bridges.	Understand	CO2	AEE511.04
14	Define Error and Explain the different types of errors in a measuring system.	Understand	CO2	AEE511.01
15	Distinguish between the terms: single point calibration and two point calibration.	Understand	CO2	AEE511.04
UNIT-II				
PROCESS CONTROL				
PART – A (SHORT ANSWER QUESTIONS)				
1	Define manipulating variable and controlled variable.	Remember	CO2	AEE511.05
2	Write the input-output relationship of a P-I-D controller.	Understand	CO2	AEE511.05
3	Explain the improvement of transient response in closed loop with P-controller.	Remember	CO2	AEE511.05
4	Define proportional band.	Understand	CO2	AEE511.05
5	Define steady state error.	Remember	CO2	AEE511.05
6	Name the three experimental techniques for controller tuning.	Remember	CO2	AEE511.06
7	Illustrate about Bump less Transfer.	understand	CO2	AEE511.06
8	Define the Integration Wind Up.	Remember	CO2	AEE511.05
9	What does controller tuning mean?	Remember	CO2	AEE511.05
10	What do you mean by Auto Tuning?	Understand	CO2	AEE511.05
11	Illustrate one method to achieve Bump less transfer.	Remember	CO2	AEE511.05
12	List the advantages of using velocity algorithm over position algorithm.	Understand	CO2	AEE511.05
13	Give an example of a time delay system.	Understand	CO2	AEE511.05
14	Identify the parameters on which the time delay is dependent.	Remember	CO2	AEE511.05
15	Illustrate an example of a process with inverse response.	Remember	CO2	AEE511.07
PART – B (LONG ANSWER QUESTIONS)				
1	Differentiate between manipulating variable and disturbance taking an example of a process.	Understand	CO2	AEE511.05
2	Distinguish with examples the difference between sequential control and continuous process control.	Understand	CO2	AEE511.05
3	Explain the advantages of P-I controller over simple P and I actions.	Understand	CO2	AEE511.05
4	Explain the guideline for selecting a controller for a process.	Understand	CO2	AEE511.05
5	Explain the importance of tuning of controller for a particular process.	Understand	CO2	AEE511.05
6	Explain the three methods for tuning of P, I and D parameters for a process.	Understand	CO2	AEE511.05
7	Explain the reaction curve technique for tuning of controller. What are its limitations?	Understand	CO2	AEE511.05
8	Define integration windup and describe two methods for prevention of Integration Windup.	Understand	CO2	AEE511.05
9	Explain a scheme for implementation of pneumatic P-I controller.	Understand	CO2	AEE511.05
10	Explain a scheme for implementation of P-I-D controller using electronic circuit.	Understand	CO2	AEE511.05
11	Distinguish between position algorithm and velocity algorithm for implementation of digital P-I-D controller.	Understand	CO2	AEE511.05

12	Draw the general block diagram of a feed forward-feedback control scheme and develop the transfer function of the feedback controller.	Understand	CO2	AEE511.05
13	Explain with an example the principle of ratio control. Elaborate with a block diagram any one scheme for achieving ratio control.	Understand	CO2	AEE511.05
14	Draw the basic scheme of a Smith Predictor for controlling a process with a transportation lag and explain its principle of operation.	Understand	CO2	AEE511.05
15	Draw and explain the operation of a compensator for compensating the inverse response of a process in a feedback control scheme.	Understand	CO2	AEE511.05
UNIT-III				
PROGRAMMABLE LOGIC CONTROL SYSTEMS				
PART – A (SHORT ANSWER QUESTIONS)				
1	Define Sequence and Logic Control.	Understand	CO3	AEE511.08
2	State three major differences between Logic Control and Analog Control.	Remember	CO3	AEE511.08
3	Define a Programmable Logic Controller.	Remember	CO3	AEE511.08
4	Name the major functions performed by a PLC.	Remember	CO3	AEE511.08
5	List few industrial sensors which provide discrete outputs.	Remember	CO3	AEE511.08
6	List few industrial sensors which provide discrete Inputs.	Remember	CO3	AEE511.08
7	Write the merits and demerits of RLL programming.	Remember	CO3	AEE511.08
8	What are the different modes of execution of a PLC program.	Remember	CO3	AEE511.08
9	Explain the basic difference between Input and Auxiliary Contacts.	Understand	CO3	AEE511.08
10	List the IEC 1131-3 standard PLC programming languages.	Remember	CO3	AEE511.08
11	What is the difference between a step of an SFC and a state of an FSM?	Remember	CO3	AEE511.09
12	Why action logic is separately indicated from step logic, although both occur in the same step?	Remember	CO3	AEE511.10
13	How is the computation for step logic different from that of transition logic?	Remember	CO3	AEE511.08
14	What is a step in SFC programming?	Remember	CO3	AEE511.09
15	What is remote I/O? How is it different from the other kinds of I/O?	Remember	CO3	AEE511.10
16	What are the functions of the blocks named MMI and programmer?	Remember	CO3	AEE511.08
17	List some of the common components present in every PLC hardware.	Remember	CO3	AEE511.09
PART – B (LONG ANSWER QUESTIONS)				
1	Explain the architecture of Programmable logic controller (PLC) with neat sketch.	Understand	CO3	AEE511.08
2	Describe the Evolution of Programmable logic controller (PLC).	Understand	CO3	AEE511.10
3	Describe the structure and program execution of a PLC program.	Understand	CO3	AEE511.08

4	Describe the typical elements of an RLL diagram.	Understand	CO3	AEE511.09
5	Design RLL diagrams for the forward and reverse control of an industrial motor.	Understand	CO3	AEE511.10
6	Draw the timing diagrams for the output coils in the RLL realizations of an on-delay, an off-delay and a fixed pulse width timer.	Understand	CO3	AEE511.08
7	Describe the major features of the IEC 1131-3 standard for PLC programming.	Understand	CO3	AEE511.08
8	Explain the difference between programming languages (SFC, FBD, Ladder Logic, Instruction list, structure text) in PLC?	Understand	CO3	AEE511.08
9	Describe the six basic control structures used in a sequential function chart (SFC) programming.	Understand	CO3	AEE511.10
10	Develop an sequential function chart (SFC) for a Simple industrial stamping process.	Understand	CO3	AEE511.08
11	Explain about function modules and counter modules used in PLC hardware.	Understand	CO3	AEE511.09
12	Describe about the input modules and output modules used in PLC hardware.	Understand	CO3	AEE511.10
UNIT – IV				
CNC MACHINES AND ACTUATORS				
PART – A (SHORT ANSWER QUESTIONS)				
1	Define computer numerically controlled (CNC) machine?	Remember	CO4	AEE511.12
2	List the important parameters of a metal cutting process.	Remember	CO4	AEE511.13
3	List out the classifications of CNC machines.	Remember	CO4	AEE511.14
4	Explain about absolute CNC systems.	Remember	CO4	AEE511.15
5	Explain about incremental CNC systems.	Remember	CO4	AEE511.12
6	What are the important parts of a control valve?	Understand	CO4	AEE511.13
7	List the classifications of control valves based on number of plugs.	Remember	CO4	AEE511.14
8	Distinguish between air-to-open and air-to-close valves.	Remember	CO4	AEE511.15
9	What is the advantage of using equal percentage valve over using linear control valve?	Remember	CO4	AEE511.12
10	State Pascal's Law and What makes petroleum oil suitable as a hydraulic fluid?	Understand	CO4	AEE511.13
11	Differentiate a finite position valve from infinite position valve.	Remember	CO4	AEE511.14
12	Illustrate the operation of pressure switches.	Understand	CO4	AEE511.15
13	Illustrate the operation of pressure relief valve.	Understand	CO4	AEE511.12
PART – B (LONG ANSWER QUESTIONS)				
1	Define Numerical Control and describe its advantages and disadvantages.	Understand	CO4	AEE511.12
2	Explain the differences between point to point and contouring CNC systems.	Understand	CO4	AEE511.13
3	What is part program? List the sequences of operations in a part program.	Understand	CO4	AEE511.14
4	Describe the open loop and closed loop CNC systems with a neat sketch.	Understand	CO4	AEE511.15
5	Explain the functioning of single seated and double seated	Understand	CO4	AEE511.12

	control valves with their merits and demerits.			
6	Explain the differences between ideal and effective characteristics of a control valve.	Understand	CO4	AEE511.13
7	Describe the principles of operation of hydraulic systems and list out its advantages.	Understand	CO4	AEE511.14
8	List the major components used in a hydraulic system and describe the functioning of each component.	Understand	CO4	AEE511.15
9	What is an accumulator? Describe the operation of spring loaded and gas charged accumulator.	Understand	CO4	AEE511.12
10	Describe the constructional and functional aspects of hydraulic pumps and motors.	Understand	CO4	AEE511.13
11	Describe the major types of direction control valves with their construction, operation and symbol.	Understand	CO4	AEE511.14
UNIT – V				
ELECTRICAL MACHINE DRIVES				
PART – A (SHORT ANSWER QUESTIONS)				
1	Define step angle of a stepper motor.	Understand	CO5	AEE511.15
2	Explain what is meant by static position error.	Understand	CO5	AEE511.16
3	Name two different modes of operation for continuous rotation.	Understand	CO5	AEE511.17
4	Distinguish between the terms full stepping and half stepping.	Understand	CO5	AEE511.15
5	Draw the block diagram a typical speed control loop for a separately excited dc motor.	Understand	CO5	AEE511.16
6	Define slip of induction motor.	Understand	CO5	AEE511.17
7	Draw the equivalent circuit of induction motor.	Understand	CO5	AEE511.15
8	Draw the torque – speed characteristics of induction motor.	Understand	CO5	AEE511.16
9	Illustrate the principle of pulse width modulation (PWM) technique.	Understand	CO5	AEE511.17
10	Explain the principle of sinusoidal pulse width modulation (SPWM) technique.	Understand	CO5	AEE511.15
11	Name two advantages and two disadvantages of a PWM inverter over a square wave inverter.	Understand	CO5	AEE511.16
12	Name applications of BLDC Motor.	Understand	CO5	AEE511.17
PART – B (LONG ANSWER QUESTIONS)				
1	Explain how a step motor is different from a conventional motor.	Understand	CO5	AEE511.15
2	Explain with schematic diagrams, open loop and closed loop control schemes used for step motors.	Understand	CO5	AEE511.16
3	Describe the realization of a variable voltage controlled source using switch mode power converters.	Understand	CO5	AEE511.17
4	Derive the dynamic speed response characteristics relating armature voltage, load torque and speed.	Understand	CO5	AEE511.15
5	Explain the major constructional features of a DC servo motor.	Understand	CO5	AEE511.16
6	Describe the operation of PWM fed induction motor drive.	Understand	CO5	AEE511.17
7	Explain the operation of Closed-loop induction motor drive with constant volts/Hz control strategy.	Understand	CO5	AEE511.15
8	Describe the principle of operation of a Permanent Magnet BLDC motor	Understand	CO5	AEE511.18
9	Explain the closed loop position control scheme of PM BLDC motor drive.	Understand	CO5	AEE511.18

10	Describe typical methods of flow control by industrial fans and pumps	Understand	CO5	AEE511.15

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