Reg. No.															

Question Paper Code	13269

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Fourth Semester

Mechanical Engineering

20MEPC401 - MEASUREMENT AND CONTROL SYSTEMS

Regulations - 2020

(Use of Semilog graph and Polar graph sheet is permitted)

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	Which of the following is a dynamic characteristic of a measurement system? (a) Accuracy (b) Precision (c) Speed of response (d) Linearity	*1*	*K1*	*CO1*
2.	Calibration of a measurement system is primarily done to: (a) Improve accuracy (b) Reduce noise (c) Increase speed of response (d) Ensure signal strength	*1*	*K1*	*CO1*
3.	In uncertainty analysis, which of the following is true? (a) Uncertainty can always be eliminated with better equipment (b) Uncertainty quantifies the doubt about the result (c) Uncertainty and error are the same (d) Uncertainty increases with higher precision	*1*	*K1*	*CO1*
4.	In block diagram the direction of arrows represents (a) The wave flow direction (b) The signal flow direction (c) The antenna flow direction (d) The transmitting line flow direction	*1*	*K1*	*CO2*
5.	Which of the following is a basic element in a control system? (a) Sensor (b) Actuator (c) Controller (d) All of the above	*1*	*K1*	*CO2*
6.	An open-loop control system: (a) Has no feedback (b) Uses feedback to adjust output (c) Is always more accurate than a closed-loop system (d) Is slower than a closed-loop system	*1*	*K1*	*CO2*
7.	The transfer function of a control system represents (a) The physical layout of the system (b) The relationship between the input and output (c) The mechanical properties of the system (d) The feedback control of the system	*1*	*K1*	*CO3*
8.	Which of the following techniques is used to simplify complex control systems? (a) Block diagram reduction (b) Signal flow graphs (c) Both a and b (d) Only transfer function analysis	*1*	*K1*	*CO3*
9.	In time response analysis, which specification refers to the maximum deviation from the steady-state value? (a) Rise time (b) Peak time (c) Maximum overshoot (d) Settling time	*1*	*K1*	*CO3*
10.	Which of the following characteristics does a second-order system exhibit? (a) Exponential growth (b) Oscillatory response (c) Linear response (d) No oscillations	*1*	*K1*	*CO4*
11.	In frequency response analysis, the Bode plot is used to (a) Show the relationship between time and amplitude (b) Represent the gain and phase shift as a function of frequency (c) Display the time response of a system (d) Show the correlation between time and frequency domains	*1*	*K1*	*CO4*

12.	The steady-state error of a control system is defined as (a) The difference between the input and output as time approaches infinity (b) The time taken for the system to reach a steady state (c) The amount of overshoot during transient response (d) The deviation from the desired output at the beginning of the response	*1*	*K1*	*CO4*
13.	Which of the following methods is used for displacement measurement using electrical resistance? (a) Capacitive method (b) Inductive method (c) Strain gauge (d) Piezoelectric sensor	*1*	*K1*	*CO5*
14.	Which type of velocity measurement involves physical contact with the moving object? (a) Contact type (b) Non-contact type (c) Inductive type (d) Capacitive type	*1*	*K1*	*CO5*
15.	Which device is commonly used for acceleration measurement based on changes in capacitance or piezoelectric effects? (a) Potentiometric type sensor (b) LVDT (c) Strain gauge (d) Piezoelectric sensor	*1*	*K1*	*CO5*
16.	Torque measurement in rotating machinery is typically done using: (a) Hydraulic load cell (b) Inline rotating sensors (c) Strain gauge (d) Proximity type sensors	*1*	*K1*	*CO5*
17.	Which of the following temperature measurement devices works on the principle of thermal expansion of metals? (a) Thermistor (b) Bimetallic strip (c) Thermocouple (d) Resistance temperature detector	*1*	*K1*	*CO6*
18.	Which of the following is most commonly used for high-temperature measurements in industrial applications? (a) Thermocouple (b) Thermistor (c) Bimetallic strip (d) Mercury thermometer	*1*	*K1*	*CO6*
19.	A manometer is primarily used to measure (a) High temperatures (b) Low temperatures (c) Atmospheric pressure (d) Differential pressure	*1*	*K1*	*CO6*
20.	Which device is used for calibrating pressure measurement instruments? (a) McLeod gauge (b) Dead weight tester (c) Pyrometer (d) Elastic pressure transducer	*1*	*K1*	*CO6*

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21.	What is the difference between static and dynamic characteristics of measurement systems?	*2*	*K2*	*CO1*
22.	Define systematic error and random error in the context of measurement systems.	2	*K1*	*CO1*
23.	What is the difference between an open-loop and a closed-loop system?	2	*K1*	*CO2*
24.	Explain the electrical analogy of mechanical systems.	2	*K2*	*CO2*
25.	What is the difference between a first-order and a second-order system response?	2	*K2*	*CO3*
26.	What are time domain specifications in a control system?	2	*K1*	*CO3*
27.	What is bode plot?	2	*K1*	*CO4*
28.	What is polar plot?	2	*K1*	*CO4*
29.	What are the types of accelerometers?	2	*K1*	*CO5*
30.	What is the working principle of a bimetallic strip in temperature measurement?	2	*K2*	*CO6*

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

31.	a)	What are the different types of errors? Explain how to eliminate errors in instruments.	*10*	*K2*	*CO1*
		OR			
	b)	Define statistical analysis in measurement systems. Outline the key steps in analyzing measurement data and discuss its application in improving measurement processes.	*10*	*K2*	*CO1*

32.	a)	Define the basic elements of a control system. Discuss their roles and interactions in achieving system stability and performance.	*10*	*K3*	*CO2*
		OR			
	b)	Find the overall transfer function of the system whose signal flow graph is shown in figure1.	*10*	*K3*	*CO2*

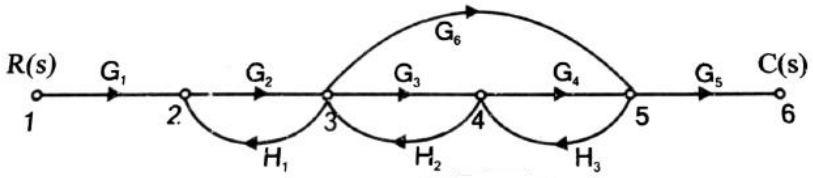

Figure 1

33.	a)	Define time response in control systems. Discuss the key time-domain specifications, including rise time, settling time, and peak time, and their significance in system performance analysis.	*10*	*K3*	*CO3*
		OR			
	b)	Derive the expression and draw the response of second order system for the un damped case with unit step input.	*10*	*K3*	*CO3*
34.	a)	Sketch the bode diagram for following transfer function and obtain the gain and phase cross over frequencies. G(s) =10/[s(1+0.4s)(1+0.1s)]	*10*	*K3*	*CO4*
		OR			
	b)	The open loop transfer function of a unity feedback system is given by G(S) =1/[S (1+S) (1+2S)]. Sketch the polar plot and determine the gain margin and phase margin.	*10*	*K3*	*CO4*
35.	a)	Compare and contrast resistive, inductive, and capacitive methods for measuring displacement. Discuss the principles behind each method and their typical applications.	*10*	*K2*	*CO5*
		OR			
	b)	Explain the working of proximity torque measurement with a neat diagram.	*10*	*K2*	*CO5*
36.	a)	Briefly compare bimetallic, thermistor, and resistance temperature detectors (RTDs) in terms of their principles and applications.	*10*	*K2*	*CO6*
		OR			
	b)	With a neat sketch, explain the working of McLeod gauge and also write its applications and advantages.	*10*	*K2*	*CO6*