

Total No. of Questions: 6

Total No. of Printed Pages: 3

Enrollment No.....



Knowledge is Power

Programme: B.Tech.

Branch/Specialisation: ME

Faculty of Engineering
End Sem Examination Dec 2024

ME3CO21 Sensors & Control

Duration: 3 Hrs.

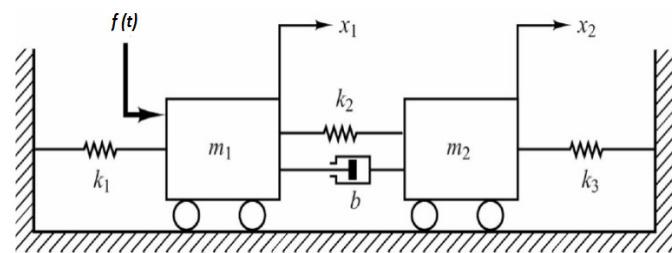
Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

	Marks	BL	PO	CO	PSO
Q.1 i. Which type of transducer converts physical pressure into an electrical signal?	1	1	1, 3	2	2, 3
(a) Thermocouple (b) Piezoelectric sensor (c) LDR (d) Microphone					
ii. Which of the following is an advantage of a closed-loop control system?	1	1	1, 4	1	1, 3
(a) Simplicity (b) Low cost (c) High accuracy due to feedback (d) No feedback mechanism required					
iii. What type of sensor is used to measure the force applied to an object?	1	1	1, 2	3	1, 2
(a) Strain gauge (b) LVDT (c) Velocity sensor (d) Infrared sensor					
iv. A sensor that measures the rate of change of velocity is called _____.	1	1	1, 2	3	1, 2
(a) Light sensor (b) Accelerometer (c) Proximity sensor (d) Strain gauge					
v. Where is the spark knock sensor typically located in an engine?	1	1	1, 3	2	2, 3
(a) On the fuel pump (b) On the intake manifold (c) On the engine block (d) On the exhaust system					

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- vi. In-home appliances, which sensor is commonly used to regulate oven temperature?
 (a) Hall effect sensor (b) Thermocouple
 (c) Proximity sensor (d) LDR
- vii. An ideal integrator circuit has which passive component in its feedback path?
 (a) Capacitor (b) Inductor
 (c) Resistor (d) Diode
- viii. The sensitivity of a closed-loop system to parameter variations is minimized by:
 (a) Open-loop configuration
 (b) Proportional control
 (c) Negative feedback
 (d) Digital control
- ix. In a proportional controller, the control output is proportional to:
 (a) Setpoint
 (b) Error signal
 (c) Time derivative of the error
 (d) Integral of the error
- x. Which of the following is an electrical prime mover used in control systems?
 (a) Servo motor (b) Hydraulic pump
 (c) Pneumatic cylinder (d) Relay
- Q.2**
- Define active and passive transducers.
 - Explain the concept of measurement system using a suitable diagram.
 - Draw the free-body diagram of the mechanical system and write the differential equations.



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| <p>OR iv. Draw the block diagram of a closed-loop control system and derive the expression for transfer function.</p> <p>Q.3</p> <ol style="list-style-type: none"> Write the working principle of RVDT. What is a strain gauge? Explain its working with application. <p>OR iii. Give the comparison between light and infrared sensors with its application.</p> <p>Q.4</p> <ol style="list-style-type: none"> How the camshaft position sensor works? Explain different types of gas sensors and their uses. <p>OR iii. Explain different types of home appliance sensors with their application.</p> <p>Q.5</p> <ol style="list-style-type: none"> Explain the working of Op-amp as a comparator. What is an ideal Op-amp? Describe its different characteristics. <p>OR iii. Draw the symbol of inverting and non-inverting operational amplifiers and explain each terminal.</p> <p>Q.6</p> <ol style="list-style-type: none"> Attempt any two: Discuss PLC system and its programming using sequence control. Define the various types of controllers with example. Explain sensor-based control of various actuators. | <p>1 2 $\frac{1}{3}$ 5 2, 3</p> <p>1 1 $\frac{1}{2}$ 3 1, 2</p> <p>1 1 $\frac{1}{4}$ 1 1, 3</p> <p>1 2 $\frac{1}{2}$ 4 1, 3</p> <p>1 2 $\frac{1}{3}$ 5 2, 3</p> <p>2 2 $\frac{1}{2}$ 3 1, 2</p> <p>3 3 $\frac{1}{4}$ 1 1, 3</p> <p>4 2 $\frac{1}{2}$ 4 1, 3</p> <p>5 3 $\frac{1}{2}$ 5 2, 3</p> <p>6 3 $\frac{1}{2}$ 3 1, 2</p> <p>7 3 $\frac{1}{4}$ 1 1, 3</p> <p>8 2 $\frac{1}{3}$ 2 2, 3</p> <p>8 2 $\frac{1}{3}$ 3 1, 2</p> <p>8 2 $\frac{1}{3}$ 2 2, 3</p> <p>7 3 $\frac{1}{4}$ 1 1, 3</p> <p>6 3 $\frac{1}{2}$ 3 1, 2</p> <p>5 3 $\frac{1}{3}$ 5 2, 3</p> <p>5 3 $\frac{1}{3}$ 5 2, 3</p> <p>5 3 $\frac{1}{3}$ 5 2, 3</p> |
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Marking Scheme
ME3CO21 (T) Sensors & Control (T)

Q.1	i) (b) Piezoelectric sensor	1	Q.3	i.	Write the working principle of RVDT.	2
	ii) (c) High accuracy due to feedback			Working principle	-2 marks	
	iii) (a) Strain gauge			ii.	What is a strain gauge? Explain its working with application.	8
	iv) (b) Accelerometer			Definition of velocity sensor	-2 marks	
	v) (c) On the engine block			Working principle	-4 marks	
	vi) (b) Thermocouple			Application	-2 marks	
	vii) (a) Capacitor			OR	iii. Give the comparison between light and infrared sensors with its application.	8
	viii) (c) Negative feedback			Comparison	-6	
	ix) (b) Error signal			marks		
	x) (a) Servo motor			Application	-2	
				marks		
Q.2	i. Define active and passive transducers.	2	Q.4	i.	How the camshaft position sensor works.	3
	Each definition one mark			Working principle	-3 marks	
	ii. Explain the measurement system using a diagram in detail.			ii.	Explain different types of gas sensors and their uses.	7
	Diagram			Explanation	-5 marks	
	Detailed description			Uses	-2 marks	
	iii. Draw the free-body diagram of the mechanical system and write the differential equations.			OR	iii. Explain different types of home appliance sensors with their application.	7
	Free body diagram			Explanation	-5 marks	
	Each differential equation			Mention application	-2 marks	
	iv. Draw the block diagram of a closed-loop control system and derive the expression of the closed-loop transfer function.	5	Q.5	i.	Explain the working of Op-amp as a comparator.	4
	Block diagram			Diagram	-2 marks	
OR	Derive the transfer function			Working	-2 marks	
				ii.	What is an ideal Op-amp? Describe its different characteristics.	6
				Definition	-2 marks	
				Diagram	-2 marks	
				Characteristics	-2 marks	
				OR	iii. Draw the symbol of inverting and non-inverting operational amplifiers and explain each terminal.	6
				Symbol	-3 marks	
				Explanation	-3 marks	

Q.6 Attempt any two:

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| i. | PLC system and its programming using sequence control | 5 |
| | PLC system | -2 marks |
| | programming using sequence control | -3 marks |
| ii. | Define the various types of controllers with an example | 5 |
| | Each (2.5*2) | -5 marks |
| iii. | Explain sensor-based control of various actuators | 5 |
| | Short note | -5 marks |
