

Enrollment No.....



Faculty of Engineering
End Sem Examination Dec 2024
ME3CO21 Sensors & Control

Programme: B.Tech.

Branch/Specialisation: ME

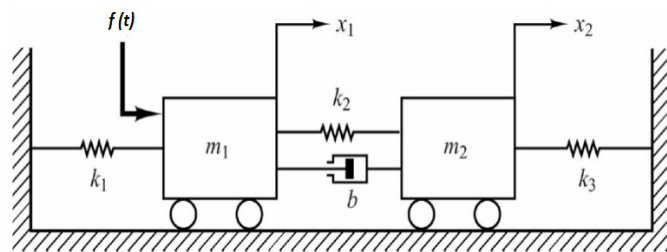
Duration: 3 Hrs.**Maximum Marks: 60**

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

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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 i. Define active and passive transducers. 2 2 1, 4 2 1, 3
ii. Explain the concept of measurement system using a suitable diagram. 3 2 1, 4 1 1, 3
iii. Draw the free-body diagram of the mechanical system and write the differential equations. 5 4 1, 2 4 1, 3



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- OR iv. Draw the block diagram of a closed-loop control system and derive the expression for transfer function. 5 4 1, 2 4 1, 3
- Q.3 i. Write the working principle of RVDT. 2 2 1, 2 3 1, 2
ii. What is a strain gauge? Explain its working with application. 8 3 1, 3 2 2, 3
- OR iii. Give the comparison between light and infrared sensors with its application. 8 2 1, 3 2 2, 3
- Q.4 i. How the camshaft position sensor works? 3 1 1, 2 3 1, 2
ii. Explain different types of gas sensors and their uses. 7 3 1, 4 1 1, 3
- OR iii. Explain different types of home appliance sensors with their application. 7 3 1, 4 1 1, 3
- Q.5 i. Explain the working of Op-amp as a comparator. 4 2 1, 2 4 1, 3
ii. What is an ideal Op-amp? Describe its different characteristics. 6 3 1, 2 3 1, 2
- OR iii. Draw the symbol of inverting and non-inverting operational amplifiers and explain each terminal. 6 3 1, 2 3 1, 2
- Q.6 Attempt any two:
i. Discuss PLC system and its programming using sequence control. 5 3 1, 3 5 2, 3
ii. Define the various types of controllers with example. 5 3 1, 3 5 2, 3
iii. Explain sensor-based control of various actuators. 5 3 1, 3 5 2, 3

Marking Scheme
ME3CO21 (T) Sensors & Control (T)

Q.1	i)	(b) Piezoelectric sensor	1
	ii)	(c) High accuracy due to feedback	1
	iii)	(a) Strain gauge	1
	iv)	(b) Accelerometer	1
	v)	(c) On the engine block	1
	vi)	(b) Thermocouple	1
	vii)	(a) Capacitor	1
	viii)	(c) Negative feedback	1
	ix)	(b) Error signal	1
	x)	(a) Servo motor	1
Q.2	i.	Define active and passive transducers. Each definition one mark	2 -2 marks
	ii.	Explain the measurement system using a diagram in detail. Diagram Detailed description	3 -1 marks -2 marks
	iii.	Draw the free-body diagram of the mechanical system and write the differential equations. Free body diagram Each differential equation	5 -2 marks -1 mark
	OR iv.	Draw the block diagram of a closed-loop control system and derive the expression of the closed-loop transfer function. Block diagram Derive the transfer function	5 -2 marks -3 marks

Q.3	i.	Write the working principle of RVDT. Working principle	2 -2 marks
	ii.	What is a strain gauge? Explain its working with application. Definition of velocity sensor Working principle Application	8 -2 marks -4 marks -2 marks
	OR iii.	Give the comparison between light and infrared sensors with its application. Comparison marks Application marks	8 -6 -2
	Q.4 i.	How the camshaft position sensor works. Working principle	3 -3 marks
	ii.	Explain different types of gas sensors and their uses. Explanation Uses	7 -5 marks -2 marks
OR	iii.	Explain different types of home appliance sensors with their application. Explanation Mention application	7 -5 marks -2 marks
	Q.5 i.	Explain the working of Op-amp as a comparator. Diagram Working	4 -2 marks -2 marks
	ii.	What is an ideal Op-amp? Describe its different characteristics. Definition Diagram Characteristics	6 -2 marks -2 marks -2 marks
OR	iii.	Draw the symbol of inverting and non-inverting operational amplifiers and explain each terminal. Symbol Explanation	6 -3 marks -3 marks

Q.6	Attempt any two:		
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	
