Total No. of Questions: 22

Enrollment No : _____

MEDICAPS UNIVERSITY

Faculty of Engineering

End Semester Examination May 2025

EE3CO69 Measurement & Control systems

Programme	:	B.Tech.	**Branch/Specialisation**	:	EE
Duration	:	3 hours	**Maximum Marks**	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

Section 1 (Answer all question(s))

		Marks	CO	BL
Q1.	Which of the following is a static characteristic of a measurement system? ○ Response time B ◉ Sensitivity ○ Bandwidth ○ Damping ratio	1	1	1
Q2.	A displacement sensor that converts physical displacement into an electrical signal is known as- ◉ Transducer ○ Actuator ○ Transmitter ○ Converter	1	1	1
Q3.	The primary function of an instrument transformer is to- ○ Reduce power dissipation ○ Modify signal frequency ◉ Isolate or scale voltage/current levels ○ Provide feedback for control	1	1	1
Q4.	What type of instrument measures the phase difference between voltage and current? ○ Amperemeter ○ Voltmeter ◉ Power factor meter ○ Frequency meter	1	1	1
Q5.	In a Linear Time-Invariant (LTI) system, the transfer function defines- ○ Time domain behavior ◉ Frequency domain behavior ○ Stability conditions ○ Control limits	1	1	1
Q6.	The Laplace transform is commonly used for which of the following purposes? ○ Time domain response analysis ○ Frequency response analysis ○ Mathematical modeling of systems ◉ Both (B) and (C)	1	1	1
Q7.	The Routh-Hurwitz criterion is applied to determine- ○ System gain ◉ Stability of the system ○ Time constant ○ System response	1	1	1
Q8.	What does a Bode plot show? ○ Time response of a system ○ Relationship between input and output ◉ Gain and phase of the system ○ All of the above	1	1	1
Q9.	Which of the following represents state variables in a state-space model? ○ System inputs ○ System outputs ◉ Minimum number of variables to describe system states ○ Any parameter influencing system behavior	1	1	1

Q10. Controllability in systems refers to- **1 1 1**

- ○ Ability to observe system outputs
- ◉ Ability to drive system states to desired values
- ○ Stability of the system
- ○ Reliability of output signals

Section 2 (Answer all question(s))

Marks CO BL

Q11. Define static characteristics of measurement systems. Provide examples. **2 1 1**

Rubric	Marks
Definition	1
Examples	1

Q12. Differentiate between sensing and actuating elements in a measurement system. **3 4 4**

Rubric	Marks
Each difference 1 marks (any three)	3

Q13. (a) Explain the significance of signal conditioning in measurement systems. **5 2 2**

Rubric	Marks
Definition of signal conditioning	2
Significance of signal conditioning	3

(OR)

(b) Discuss the types of sensors, classifying them based on different criteria.

Rubric	Marks
Types	2
Classification	3

Section 3 (Answer all question(s))

Marks CO BL

Q14. Calculate the power consumed in a circuit with a voltage of 230V and a current of 10A, considering a power factor of 0.8. **3 3 3**

Rubric	Marks
Calculate Power	3

Q15. (a) Explain the operation of a digital voltmeter, including its advantages over analog meters. **7 2 2**

Rubric	Marks
Operation with diagram	4
Advantage	3

(OR)

(b) Describe the functions and operation of oscilloscopes in electrical measurements.

Rubric	Marks
Function	3
Operation with diagram	4

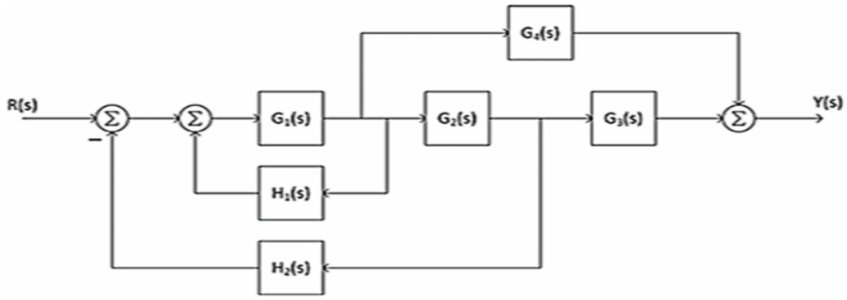
Section 4 (Answer all question(s))

Marks CO BL

Q16. Describe mathematical modeling of a first-order linear time-invariant system and find its transfer function. **3 2 2**

Rubric	Marks
mathematical modeling of a first-order linear time-invariant system	1
transfer function	2

Q17. (a) Find the transfer function- **7 5 5**



Rubric	Marks
Each step 1 mark	7

(OR)

(b) Explain the importance of error analysis in electrical measurements.

Rubric	Marks
Each importance 1 mark	7

Section 5 (Answer all question(s))

Marks CO BL

Q18. Describe the Routh-Hurwitz stability criterion. How it is applied to analyze system stability? **3 2 2**

Rubric	Marks
Description	2
analyze system stability	1

Q19. (a) Explain the concept of frequency response. How Bode plots can be utilized to determine system behavior? **7 2 2**

Rubric	Marks
concept of frequency response	3.5
Bode plots can be utilized to determine system behavior	3.5

(OR)

(b) Sketch the root locus of the unity feedback system having-

$$G(s) = \frac{K}{s(s+2)(s+4)}$$

Rubric	Marks
Each step 1 mark	7

Section 6 (Answer any 2 question(s))

Marks CO BL

Q20. Explain state space representation of linear time-invariant systems. Include derivations and examples. **5 2 2**

Rubric	Marks
state space representation	2.5
derivations and examples	2.5

Q21. Discuss controllability and observability in state-space systems. How do they affect system design? **5 4 4**

Rubric	Marks
controllability and observability.	2.5
How do they affect system design.	2.5

Q22. Provide a detailed explanation of the State Transition Matrix and determine the State Transition Matrix Φ(t) for the given system- **5 3 3**

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

Rubric	Marks
Each step 1 mark	5

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