KUMARAGURU
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B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2022
(Regulation 2018)
Third Semester
ELECTRONICS & INSTRUMENTATION ENGINEERING
U18EII3202 : Sensors and Measurements

COURSE OUTCOMES
CO1: CO1: Describe the characteristics and construction details of different sensors.
CO2: CO2: Analyze suitable signal conditioning circuits for resistive, reactance, and self-generating sensors.
CO3: CO3: Explain the fundamental concepts and working principle of analog and digital meters.
CO4: CO4: Analyze the specification details for the given sensor/Instrument.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 1 = 10 Marks)

1. Match the following: CO1 [K_2]

List I	**List II**
A. LVDT	i. Displacement sensitive
B. Capacitive Type Transducer	ii. Motion Transducer
C. Piezo-electric Transducer	iii. Magnetic Coupling
D. Electromechanical Type Transducer	iv. Crystalline Material

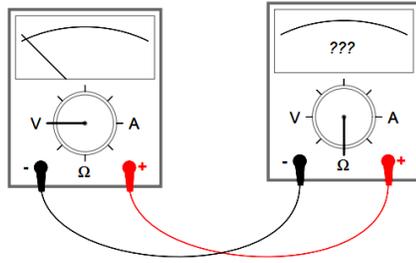|	A	B	C	D
a)	iii	ii	i	iv
b)	i	iv	ii	iii
c)	iii	iv	i	ii
d)	iii	i	iv	ii

2. Dead zone of an instrument is CO1 [K_1]
   a) The largest change of input quantity for which there is no output of the instrument
   b) The time required by an instrument to begin to respond to a change in measurand
   c) The unmeasured quantity which exceeds the maximum range of the instrument
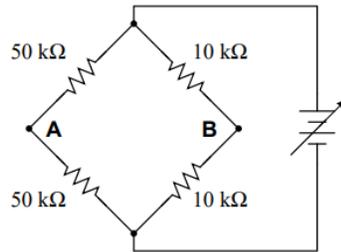   d) The time required by an instrument to warm up initially

3. Which of the following are piezoelectric substances? CO4 [K_1]
   1. Barium titanate
   2. Lead titanate
   3. Lead Zirconate
   4. Cadmium and sulphate
   a) 1, 2 and 4
   b) 1, 3 and 4

c)   1, 2 and 3   d)   2, 3 and 4

4. The typical conversion speed of ADC is _____.   CO2 [K₂]
   a) Less than 1 µs
   b) Less than 100 µs
   c) Less than 500 µs
   d) Greater than 1000 µs

5. Assertion (A): Sensors are almost always transducers, but transducers are not necessarily   CO1 [K₂]
   sensors.
   Reason (R): Sensors are transducers that convert physical quantity to a measurable quantity.
   a) Both A and R are Individually true and
      R is the correct explanation of A
   b) Both A and R are Individually true but
      R is not the correct explanation of A
   c) A is true but R is false
   d) A is false but R is true

6. Which of the following is not an AC bridge?   CO2 [K₂]
   a) Kelvin bridge
   b) Maxwell bridge
   c) Hay bridge
   d) Schering bridge

7. The correct sequence of the following types of ammeters with increased accuracy is   CO3 [K₂]
   1. Moving Iron type
   2. Permanent Magnet Moving Coil type
   3. Induction type
   a) 1, 3, 2
   b) 2, 1, 3
   c) 1, 2, 3
   d) 3, 1, 2

8. Q meter works on the principle of _____.   CO3 [K₂]
   a) Barkhausen criterion
   b) piezoelectric effect
   c) parallel resonance
   d) series resonance

9. Assertion (A): A transducer needs an output measuring or display device for measuring a   CO2 [K₂]
   non-electrical quantity.
   Reason (R): In some transducers, the output voltage is too small and needs amplification before
   it can be measured.
   a) Both A and R are Individually true and
      R is the correct explanation of A
   b) Both A and R are Individually true but
      R is not the correct explanation of A
   c) A is true but R is false
   d) A is false but R is true

10. In portable instruments, damping is provided by   CO4 [K₂]
    a) spring
    b) gravity
    c) eddy current
    d) either (a) or (c)

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. Calculate the gauge factor of a strain gauge, if the value of resistance is 152 Ω, which changes   CO4 [K₃]
    by 5 Ω for 5000 microstrains.

12. If we were to connect a voltmeter directly to an ohmmeter, what would you expect to see the   CO3 [K₃]
   ohmmeter register, for resistance between its test leads?

13. State the dynamic characteristics of a simplified measuring system. CO1 [K₁]
14. What will happen to the voltage between points A and B if the power supply voltage increases? Justify. CO3 [K₃]


15. List out the types of input circuits used in signal conditioning. CO2 [K₂]
16. Define inverse transducer with an example. CO1 [K₁]
17. Suggest sensors that could be used in the following situations: CO4 [K₃]
    a) To monitor the displacement of a rod and give a voltage output.
    b) To monitor a rapidly changing temperature.
18. Write any four basic requirements of the transducer. CO4 [K₂]
19. What is a resolver to digital converter? CO2 [K₁]
20. Name the Biosensor used for pregnancy test. CO2 [K₂]

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 350 words)

21. a) Describe the functional elements of an instrument with its block diagram. 10 CO1 [K₂]
    b) Distinguish between 4 CO1 [K₂]
        i) Accuracy and Precision
        ii) Range and Span

22. a) Which electromagnetic sensor is used to sense the angular position of a shaft? Explain the same in detail with necessary schematic diagram. 12 CO4 [K₃]
    b) What would you expect the voltmeter in the following circuit to do when the potentiometer wiper is moved to the right? 2 CO4 [K₃]
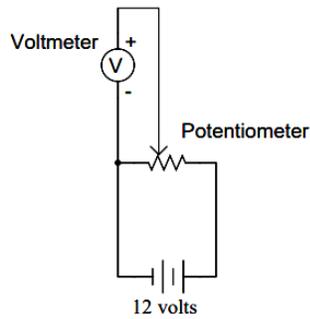
23. a) Describe the construction and function of a moving iron voltmeter with the required diagrams. 10 CO3 [K₂]

b) This bridge circuit is supposed to generate an output voltage proportional to the difference between light exposure on the two photocells: 4 CO3 [K₄]
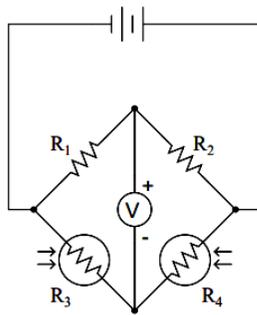
However, something has failed in this circuit, because the voltmeter is "pegged" fully negative and was not changing with varying light exposures on the two cells. Identify at least two possible failures that could cause the voltmeter to over-range in the negative direction.

24. With a neat sketch explain the operation of LVDT. List its advantages and disadvantages. 14 CO2 [K₂]

25. a) With the aid of neat sketch, explain the working principle of piezoelectric transducer. Also, discuss its different modes of operation. 10 CO4 [K₂]

b) State the properties of piezoelectric crystals. 4 CO4 [K₂]

26. a) What are intelligent sensors? State their components and discuss their features. 10 CO1 [K₂]

b) Recall the different types of thermocouple and the materials used for constructing each type. 4 CO1 [K₂]

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