END SEMESTER/ RE-TEST EXAMINATION, 2020
Semester: 6th
Subject Code: CAI-503
Subject: Principles of Instrumentation
Full Marks: 70
Time: 3 Hours

The Question Paper consists of two parts: Part-A and Part-B. Both are compulsory.

Part-A (Marks = 25)
All questions are compulsory

1Q: Match the followings from Column A with Column B.   [5]

Column A [Device Name]	Column B [I/p physical quantity to the device]
Thermopile	Liquid level
LVDT	Flow rate
Dielectric gauge	Displacement
Venturimeter	Light
Solar cell	Temperature

2Q: State whether the following statements are true or false.   [10]
- i) All precise measurements are not accurate.
- ii) It is possible to have direct measurement of the temperature of the sun.
- iii) To prevent loading of circuit under test, the input impedance of the ammeter must be very high.
- iv) CRO can be also called as X-Y plotter.
- v) Thermocouples when connected in series are known as thermopile.
- vi) An indication of the precision of the measurement is obtained from the number of significant figures in which it is expressed.
- vii) It is impossible to remove residual errors in the measurement process.
- viii) The example of a first order system is thermometer.
- ix) The transfer function of a linear time invariant system is defined to be the ratio of Laplacetransform of the output variable to the Laplace transform of the input variable with all initial conditions are zero.
- x) Mass-Spring-Damper system is an example of second order system.

3Q: Fill in the blanks.   [10]
- i) Orifice is used for measurement of _____
- ii) LVDT has _____ secondary coils.
- iii) The commonly used material in construction of LCD screen is _____.
- iv) The semiconductor material commonly used for construction of LED is _____.
- v) A meter reads 12.50 V and the true value of the voltage is 12.17 V. The static error is _____
- vi) Earth electrode provides _____ resistance.
- vii) The span of an instrument is expressed by _____.
- viii) For a second order system the settling time for ± 5% band is _____.
- ix) _____ is defined as the largest change in the measurand to which the instrument does not respond.

x)   Laplace transform of unit step signal is_____.

Part-B (Marks = 45)
Answer any five (5) questions

Q4 :   a) The following figure portrays a schematic diagram of a spring balance measuring device with electrical readout. Now you identify and write down the basic and auxiliary functional elements in it.   [4]
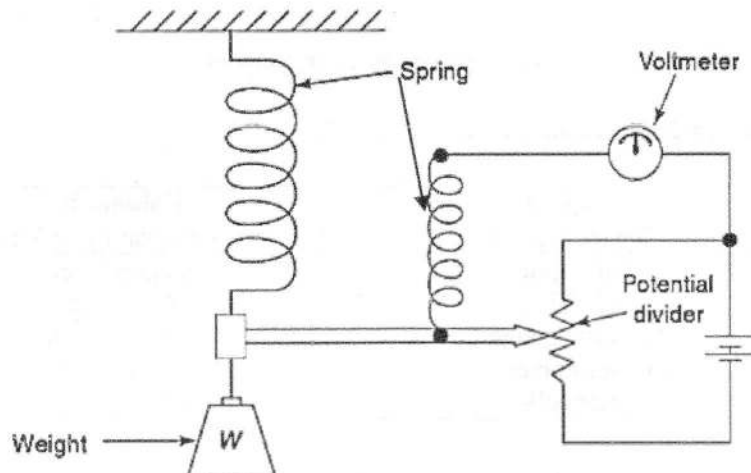
b) A voltmeter with internal resistance of 100kΩ is connected across an unknown resistance. It reads 150V and the milli-ammeter connected in series with the same resistance reads 15mA. Determine the apparent resistance, actual resistance and the loading error due to the voltmeter. [6]

Q5 :   a) Show the diode arrangement for common-cathode and common-anode segment display units.
                                                                                                              [3]
b) A thermometer reads $95.45^{0}C$ and the static correction given in the correction curve is $-08^{0}C$. Determine the true value of the temperature.
                                                                                                              [2]
c) What is the difference between a primary and secondary transducer? Explain with an example.
                                                                                                              [4]

Q6 :   a) Name any four different types of data presentation element.   [4]
b) State the three thermoelectric effects known as Seeback, Peltier and Thomson effect in brief.
                                                                                                              [5]

Q7 :   a) What is an LED? Name two devices where LEDs are used to display alphanumeric characters.
                                                                                                              [3]
b) What are different standard test signals that are used as inputs in various types of instruments/transducers?   [4]
c) State the number of significant figures in the followings: [2]

> 7.95×10^4
> 0.00050

Q8 :   a) Explain with a suitable diagram the working principle of a capacitive transducer used for non-conducting liquid level measurement.   [5]
b) State the advantages of digital display over analog one.   [3]

2

c) For a thermometer calibrated between 200°C to 500°C, specify the scale span. [1]

Q9 : a) What are the two different forms by which the accuracy of an instrument can be specified? Also state their expressions. [3]

b) Define the following terms: [6]

- Resolution
- Hysteresis
- Linearity

Q10 : a) Describe the functions of each block of CRO with a suitable diagram. [5]

b) Write short notes on: (any one) [4]

- Plate earthing
- LCD display
-

****