Total number of printed pages: 2 **B.Tech.(UG)/3rd/UIE304**

2022

Fundamental of Instrumentation

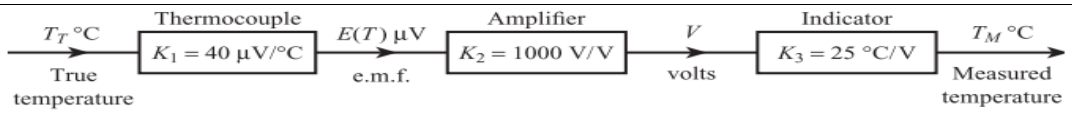
Full Marks: 100

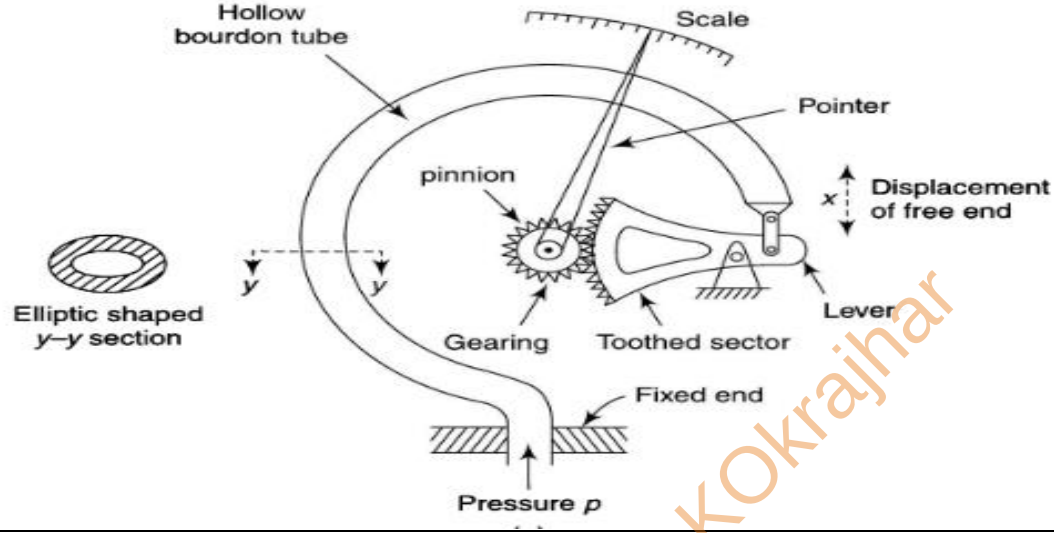
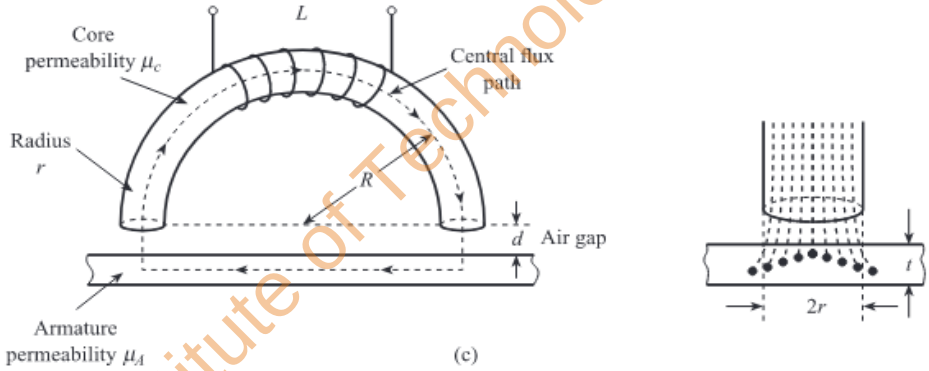
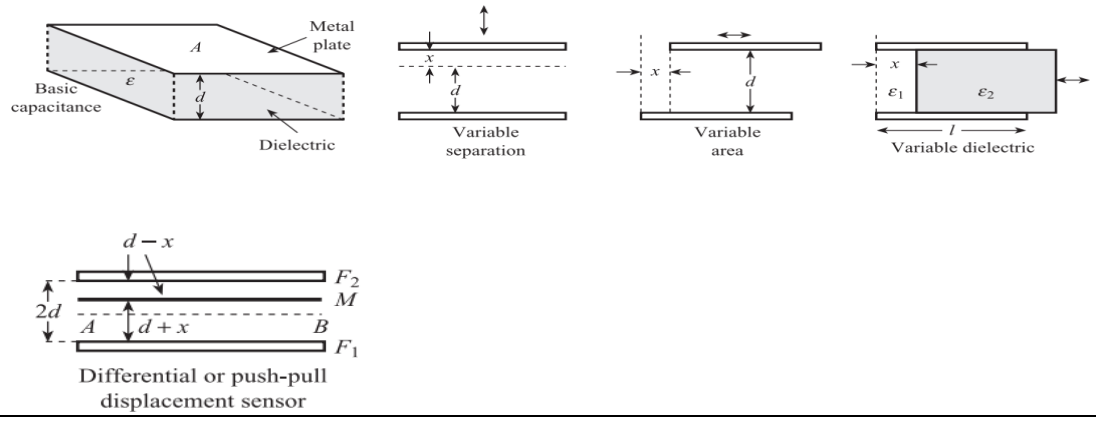
Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a	Draw the Instrumentation amplifier circuit with output equation and advantages?	10
	b	Discuss the characteristics of an ideal operational amplifier.	5
	c	How to check the linearity of a system?	5
2.	a	A 200mA ammeter has an internal resistance of 10Ω. For extending its range to measure 600mA, find the shunt resistance required.	10
	b	Draw a non-inverting amplifier circuit.	5
	c	What is loading effect?	5
3.	a	The table given below of measure values. Values are 52, 53, 54, 55, 56, 57, 58, 59 and frequency of occurrence 5, 2, 4, 6, 8, 10, 6, 2. Calculate Mean, Mode Median; Mean absolute deviation, standard deviation.	10
	b	Explain the Gaussian distribution curve and write the equation.	5
	c	What is the input impedance of an inverting and non-inverting operational amplifier?	5
4	a	i)Define Gauge factor. ii)A strain gauge has a gauge factor of 4. If it is stretches from 0.45m to 0.455m, what is the percentage change in resistance?	2 8
	b	Discuss the salient features of a first order system with step input.	5
	c	What is the systematic error? Explain.	5
5.	a	i)Explain the Traceability ladder in terms of Primary, Secondary, working standards. ii)What is the secondary standard for Pressure measurement. Explain the salient features of the standard equipment for accepting it as standard for calibration of Pressure itransmitters..	5 5
	b	i)Explain the Generalised model of a system element given by the formula: $O = KI + a + N(I) + K_M I_M I + K_I I_I$ ii)What is the influence of Modifying and Interfering Input in the system output.? Explain. Give one example each in reference to instrument elements.?	3 2
	c	i)Sketch the circuit of a passive high-pass RC filter and explain its operation. ii) Determine the cut-off frequency for the low-pass RC filter, given R = 1500 Ω and C=1000 pF.	3 2
6.	a	Explain the following SI electrical unit : i)Current ii) Emf iii) Conductance iv) Magnetic flux v) Capacitance Express the Dimensions of the following mechanical and electrical quantity:- vi) Force vii) Work viii) Power ix) Voltage x) Resistance	1x5 1x5
	b	1)Explain the importance of signal conditioning in the field instrumentation. Discuss three features of signal conditioning. ii) Draw the circuit of intrinsic safety device used in signal conditioning.	3 2
	c	The temperature measuring system consists of a Thermocouple, amplifier and Indicator with the individual sensitivities as shown in the block diagram. Determine the deflection of the indicator if the temperature Tτ is 100 ° C.	5



7.	a		10
		For the Pressure measurement system using a Bourdon tube pressure gauge, explain the functional block elements with a schematic diagram. (Name the input and output physical effects of the functional blocks.)	
	b		5
		For the element with n=500 turns, R =2 cm, r = 0.5 cm, t = 0.5 cm, μc = μA = 100, has ℜo=1.3 x 10^7 H^{-1}, k=2x 10^{10} $H^{-1}m^{-1}$. $\mu_0 = 4\pi \times 10^{-7}$ H m^{-1}Determine "L" in mH units at d=0 (zero air gap) ONLY for the semi arc section.	
	C	Write down the Capacitance of the various configurations shown in the figures:- The width of the plate is " *w* ". 	1x5