

Total No. of printed pages = 4

ECE 181405

11/8/22

Roll No. of candidate

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2022

B.Tech. 4th Semester End-Term Examination

INSTRUMENTAION

(New Regulations & New Syllabus)

Full Marks – 70

Time – Three hours

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

Answer question No. 1 and any *Four* from the rest.

1. Answer the following (MCQ/ Fill in the blanks) : (10 × 1 = 10)
- (i) The brightest spot, on a cathode ray screen, occurs at
- (a) The centre
 - (b) The outer periphery
 - (c) Midway between centre and outer periphery of screen
 - (d) Brightness is same all over the screen
- (ii) A C.R.O. can be used to measure
- (a) A.C. voltages only
 - (b) D.C. voltages only
 - (c) Frequency
 - (d) Any of the above
- (iii) LVDT windings are wound on
- (a) steel sheets(laminated)
 - (b) aluminium
 - (c) ferrite
 - (d) copper
- (iv) Piezoelectric crystals are used for the measurement of
- (a) temperature
 - (b) velocity
 - (c) sound
 - (d) none of the above
- (v) In Maxwell's Inductance-Capacitance bridge, the frequency ω
- (a) Is directly proportional to the inductance in the balanced equation
 - (b) Is inversely proportional to the capacitance in the balanced equation
 - (c) Is directly proportional to the product of inductance and capacitance
 - (d) Does not appear in the balanced equations

[Turn over

3. (a) Mention the disadvantages of Wheatstone bridge for the measurement of low resistance.
- (b) With proper circuit diagram find the equation for the measurement of unknown resistance using Kelvin's double bridge.
- (c) With proper circuit and phasor diagram find the equation for the measurement of unknown inductance using Hay's bridge.
- (d) A sheet of Bakelite 4.5 mm thick is tested at 50 Hz between electrodes 0.12m in diameter. The Schering's bridge employs a standard air capacitor C_2 of 106 pF capacitance, a non reactive resistance R_4 of $1000/\pi \Omega$ in parallel with variable capacitor C_4 and a non reactive variable resistance R_3 . Balance is obtained with $C_4 = 0.5 \mu\text{F}$ and $R_2 = 260 \Omega$. Calculate the capacitance, power factor and relative permittivity of the sheet. (2+5+5+3=15)
4. (a) What do you mean by swamping resistance?
- (b) What do you mean by burden voltage?
- (c) With proper diagram explain the working of series ohmmeter. Also explain ohmmeter with zero adjust.
- (d) Assume an ohmmeter circuit has $E_B = 1.5\text{V}$, $R_1 = 15\text{k}$, $R_m = 50$, $R_2 = 50 \Omega$, and meter FSD = $50 \mu\text{A}$. determine the ohmmeter scale reading at 0.5 FSD, and determine a new resistance value that R_2 must be adjusted to when E_B falls to 1.3 V. Also recalculate the value of R_x at 0.5 FSD when $E_B = 1.3 \text{V}$. [2+2+6+5=15]
5. (a) With diagram explain Binary weighted resistor DAC. What are its disadvantages?
- (b) How the disadvantage of Binary weighted resistor DAC has been overcome in R-2R ladder DAC.
- (c) Explain with diagram and an example of unknown weight the working of successive approximation ADC. [5+5+5= 15]
6. (a) Mention the points that need to be considered in determining a transducer suitability for a specific measurement.
- (b) With the help of a neat sketch explain the principle, working, construction, characteristics and application of LVDTs.
- (c) A strain gauge has a gauge factor of 4. If the strain gauge is attached to a metal bar that stretches from 25 cm to 25.2 cm. Calculate the percentage change in its resistance. If the unstrained value of resistance is 120 ohm, what would be the value after strain is applied?
- (d) A copper- constantan thermocouple has $\alpha = 37.5 \mu \frac{V}{^\circ\text{C}}$ and $\beta = 0.0045 \mu \frac{V}{^\circ\text{C}}$. Determine the emf developed by the thermocouple when its hot junction is at 200°C and cold junction is kept in ice. [3+6+3+3=15]

7. Write short notes on : (any three)

(3 × 5 = 15)

- (a) GP-IB
- (b) Q-meter
- (c) Digital storage oscilloscope
- (d) Spectrum Analyzer

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