E-T-VI Sem.

Roll No.

No. of Printed Pages—4   EC-604

B. TECH.

SIXTH SEMESTER EXAMINATION, 2002-2003

MEASUREMENTS & INSTRUMENTATION

Time : 2 Hours   Total Marks : 50

1. Attempt any FOUR parts of the following :—   (4×4=16)

    (a) Explain the construction and working of the Weston type frequency meter.

    (b) Describe the construction and working of a single phase electrodynamometer type of power-factor meter.

    (c) A voltmeter reading of 70 V on its 100 V range and an ammeter reading of 80 mA on its 150 mA range are used to determine the power dissipation in a resistor. Both these instruments are guaranteed to be accurate within ± 1·5% at full-scale deflection. Determine Power and limiting error of the Power.

    (d) Explain the term, Noise Factor.

        A differential amplifier with a common-mode input of 500 mV and a difference mode input of 30 mV has an output of 5 mV due to the common mode input and 3 V due to difference mode input. Find the Common Mode Rejection Ratio (CMRR).

    (e) What method can be used to increase the frequency range of frequency counter ? How can this be achieved without degrading the accuracy of the counter ?

    (f) Write short notes on R-F impedance measurement.

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2. Answer any TWO of the following :— (5×2=10)

(a) What are three major classes of digital displacement transducers ? Discuss their merits and demerits. Why is the Gray code preferred to binary code in commercial encoders ?

The output of an LVDT is connected to a 5 V voltmeter through an amplifier with a gain of 250. The voltmeter scale has 100 divisions and the scale can be read to 1/5th of a division. An output of 2 mV appears across the terminals of the LVDT, when core is displaced through a distance of 0·5 mm. Calculate and determine :

(i) Sensitivity of LVDT and entire set-up,

(ii) The resolution of instrument.

(b) Draw the equivalent circuit of a peizo electric transducer and hence deduce that the output is zero when the pressure is static. State advantages and disadvantages of peizo electric transducer.

A quartz peizo electric transducer has the following specifications :—

area = 1 cm^2, thickness = 1 mm, Young's modulus = 9×10^{10} Pa, charge sensitivity = 2 p C/N, relative permittivity = 5 and resistivity = 10^{14} Ω cm. A 20 pF capacitor and a 100 MΩ resistance are connected in parallel across the electrodes of peizo electric transducer. If a force F = 0·02 sin (10^3t) N is applied, calculate :

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(i) Peak to peak voltage generated across the electrodes, and

(ii) the maximum change in crystal thickness.

(c) What are different transducers used for temperature measurement ? Compare and contrast a thermo-couple and thermistor as temperature transducers.

A platinum resistance thermometer is used to measure the temperature between 0°C and 200°C. Given that resistance at t °C as $R_t = R_0 \left(1 + \alpha t + \beta t^2\right)$, $R_0 = 100.0\ \Omega$

$R_{100} = 138.50\ \Omega$ and $R_{200} = 175.83\ \Omega$, calculate the nonlinearity at 100°C as a per cent of full-scale deflection.

3. Attempt any THREE of the following :— (4×3=12)

(a) Write short notes on IEEE standard instrumentation bus.

(b) Draw the block diagram of Telemetry System and explain its working.

(c) What are "ROSETTES" ? Compare its advantages and disadvantages, in brief, with that of plain strain gauges.

(d) Explain, with block schematic, the working principle of A/D converter using D/A converter.

(e) It is required to design a data acquisition system with the following requirements :—

(i) No. of channels = 4

(ii) Minimum frequency = 1·2 KHz

(iii) Maximum frequency = 15 KHz

(iv) Minimum input level = 20 mV

(v) Maximum input level = 1 V

Suggest a block based schematic of the proposed system assuming a 5 V unipolar 12 bit ADC is available.

Describe the specifications of the different blocks of the system.

4. Attempt any TWO parts of the following :—   (6×2=1̶

   (a) What are different alphanumeric display devices ? Give the construction and principle of field effect type LCD. Compare LED and LCD displays.

   (b) Draw the block diagram of storage oscilloscope and explain the working of each block.

   (c) What are the applications of Spectrum Analyzer ? Draw the block diagram of Spectrum Analyzer and explain its working.

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