

Code No: R31044

R10

Set No:1

III B.Tech. I Semester Supplementary Examinations, June/July - 2014

ELECTRONIC MEASUREMENTS AND INSTRUMENTATIONS

(Comm to Electronics and Communication Engineering & Electronics and Instrumentation Engineering)

Time: 3 Hours**Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) The value of a resistor is measured by the voltmeter-ammeter method. The voltmeter reading is 123.4V on the 250V scale and the ammeter reading is 283.3mA on the 500mA scale. Both meters are guaranteed to be accurate within $\pm 1\%$ of full-scale reading. Calculate (i) the indicated value of the resistance (ii) the limits within which one can guarantee the result.
(b) Define accuracy and precision.
(c) Draw the schematic representation of a basic thermocouple instrument using thermocouple CDE and PMMC movement and explain its working.
2. (a) Draw the simple block diagram of simple sin-wave generator and explain its principle of operation.
(b) Explain how PIN diode is used in audio frequency generators?
3. (a) Draw the Block diagram of General-purpose spectrum analyzer and explain the significance of each block.
(b) What is a wave meter? What are the applications of it?
4. (a) What are the requirements of a vertical amplifier of a CRO?
(b) Draw the circuit diagram of a two stage attenuator used in HF CRO and explain its working.
5. (a) Explain the process of secondary emission with experimental circuit used in storage oscilloscope.
(b) What are the Lissajous figures? How these are used in measurements?
6. (a) What are the limitations of the Wheatstone bridge for measurement of low resistances?
(b) In a Wien bridge, arm ab consists of a lossy capacitor (C_2 and R_2); arm bc and cd are non-inductive resistance of $1K\Omega$ each; arm da is a standard capacitance of 0.01Ω resistor. Find the values of C_2 and R_2 . The citation frequency is 7500 rads^{-1} .
7. Explain the working of the following piezoelectric transducers:
(a) Force (b) Strain (c) Torque (d) Pressure
8. (a) Compare the analog and digital data acquisition systems.
(b) What type of transducer is used to measure displacement and Explain how is it measure.

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1. (a) If two quantities are defined by $P_a = 210 \pm 2.1$ and $P_b = 100 \pm 1.5$, find the limiting error of their sum, difference, product and quotient.
(b) Distinguish between precision and accuracy. Give some examples.
(c) Draw the basic dc voltmeter circuit and define its sensitivity and how its range can be extended.
2. (a) Explain the principle of working of sine wave signal generator with frequency counter and automatic level control.
(b) Draw the simple sweeping oscillator signal generator and explain how to linearize the circuit?
3. (a) Explain how spectrum analyzer is similar to an up-converting superheterodyne receiver?
(b) Draw the functional block diagram of the heterodyning wave analyzer and explain the function of each block.
4. (a) Draw the block diagram of a vertical deflection system and explain its functioning.
(b) How do you use CRO as X-Y recorder?
(c) What are the limitations of storage CRTs?
5. (a) Explain how frequency and period are measured by using CRO?
(b) Explain the working of storage CRT with multiple targets and two electron guns.
6. (a) Draw the circuit diagram of Maxwell's inductance bridge and derive the condition for bridge balance.
(b) What are the sources of errors in measurements using Wheatstone bridge?
7. (a) The unstrained resistance of each of the four elements of the unbounded strain gage is 120Ω . The strain gage has a gage factor of 3 and is subjected to a strain ($\Delta l/l$) of 0.0001. If the indicator is a high impedance voltmeter, calculate the reading of this voltmeter for a battery voltage of 10V.
(b) What are the factors to be taken into consideration while choosing a transducer? Explain them.
8. (a) What are the different elements of analog data acquisition system? Explain the function of each element.
(b) What type of transducer is used to measure moisture and explain the procedure of measurement.

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Time: 3 Hours**Max Marks: 75**Answer any FIVE Questions
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1. (a) Ratings of two resistors are as follows: $R_1 = 36\Omega \pm 5\%$ and $R_2 = 75\Omega \pm 5\%$. Calculate (i) magnitude of error in each case (ii) the limiting error in ohms and in percent when resistors are connected in series and (iii) the limiting error in ohms and in percent when the resistors are connected in parallel.
(b) What are gross errors? Give some examples.
(c) Draw the circuit diagram of thermal type of RMS voltmeter and explain its function and also write its limitations.
2. (a) Draw the block diagram of wideband sweep generator and explain its working.
(b) Why a RC network is preferred in an audio frequency signal generator?
3. (a) What is the function of PLL circuit in a spectrum analyzer?
(b) Explain the working of audio-range wave analyzer with neat block diagram.
4. (a) Define electrostatic deflection sensitivity. On what factors does it depend?
(b) Draw the block diagram of CRO and explain the working of each block.
5. (a) How current probe is capable of measuring from dc to several megahertz?
(b) Draw the simplified block diagram of the sampling circuitry and explain it.
6. (a) An Anderson bridge is arranged as follows: The arm ab consists of an inductive resistance (L_1, R_1); arms ad and dc consists of non-inductive resistance of 600Ω each; arm de and eb consists of resistance 400Ω and 800Ω each respectively; arm ec is a capacitor for value $0.1\mu\text{F}$. Calculate L_1 and R_1 .
(b) Explain how Q-meter is used to measure high impedance component in the parallel connection.
7. (a) A resistance strain gage with a gage factor of 2.4 is mounted on a steel beam whose modulus of elasticity is $2 \times 10^6 \text{ Kg/cm}^2$. The strain gage has an unstrained resistance of 120Ω which increase to 120.1Ω when the beam is subjected to a stress. Calculate the stress at the point where the strain gage is mounted.
(b) What are the different types of piezoelectric transducers? Explain their working.
8. (a) Name four types of electrical pressure transducer and explain one application of each type.
(b) What type of transducer is used to measure humidity and explain the procedure of measurement.

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Time: 3 Hours**Max Marks: 75**

Answer any FIVE Questions

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1. (a) The following set of six measurements are made on the power consumed by an electric bulb: 40.32, 40.50, 39.83, 39.92, 40.01 and 40.40 W. Calculate the average power and error range.
(b) What are the limiting errors? Give some examples.
(c) Draw the circuit diagram of a balanced-bridge DC voltmeter and explain its working.
2. (a) Explain how an astable multivibrator is used to generate a square wave?
(b) What are the basic elements of a function generator and explain the need of each element.
3. (a) What is the dynamic range of a spectrum analyzer with a third-order intercept point of +25 dBm and a noise level of -85 dBm?
(b) What are the applications of a spectrum analyzer?
(c) Explain how a wave analyzer is used to measure the relative amplitudes of single frequency components in a complex waveform?
4. (a) Explain the need of a delay line in the vertical input system of a CRO.
(b) Discuss the loading effect of the input circuit of a CRO on the signal source.
(c) What is a graticule? What factors determine its accuracy?
(d) How are phosphors used for different color displays?
5. (a) Why is a compensating capacitor needed in a 10 to 1 probe?
(b) How does a sampling oscilloscope increase the apparent frequency response of an oscilloscope?
6. (a) Calculate the capacitance, the equivalent series resistance and power factor of the capacitor C_1 of the Schering bridge at 50 Hz. The parameters are: $C_2=106\text{pF}$, $R_3=120\Omega$, $R_4=360\Omega$ and $C_4=0.4\mu\text{F}$.
(b) Explain how a Q-meter is used to measure the electrical properties of coils?
7. (a) What are the different types of classification of transducers? Explain them.
(b) The LVDT produces an output of 2 V rms for a displacement of 50×10^{-6} cm. Calculate the sensitivity of the LVDT in $\mu\text{V/mm}$. The 2-V output of the LVDT is read on a 5-V voltmeter that has a scale with 100 divisions. The scale can be read to 0.2 division. Calculate the resolution of the instrument in terms of displacement in inches.
(b) What are the uses and limitations of piezoelectric transducers? Give some examples.
8. (a) What are the different elements of a digital data acquisition system? Explain the function of each element.
(b) What are the uses and limitations of piezoelectric transducers? Give some examples.

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