

**III B.Tech Supplementary Examinations, Aug/Sep 2008**  
**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
( Common to Electronics & Communication Engineering and Electronics & Telematics)

**Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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1. (a) What type of errors are possible in dual slope integrator and suggest methods to minimize and eliminate them?  
(b) A dual slope integrating type A/D converter has an integrating capacitor of 0.1micro farads and resistance of 100 kilo ohms. If the reference voltage is 5V, and output of the integration is not to exceed 15V. What is the maximum time the reference voltage can be integrated. Derive the formula used. [8+8]
2. (a) A Maxwell bridge is used to measure an inductive impedance at a frequency of 3 kHz. The bridge constants at balance are arm 1: a capacitor of value  $0.02 \mu F$  in shunt with 390 kohm; arm 3 opposite to the arm 1 is having the unknown component; the other arms have each 18 kohm resistor. Find the equivalent series circuit of the unknown impedance. What is the value of the quality factor?  
(b) What is the usual procedure for balancing the Maxwell bridge? What is the necessity for following such a procedure? Explain with the circuit diagram. [8+8]
3. (a) Explain various methods of measuring the impedance of a circuit using Q ? meter.  
(b) Explain the working principle of a Q meter. [8+8]
4. (a) Explain the following:
  - i. Time interval measurements
  - ii. Single period measurements.(b) Explain the mechanism of a calibrating a local frequency source. [5+5+6]
5. (a) Derive the equations for Resistive voltage divider and capacitive voltage divider of compensated attenuator .  
(b) Explain the method of finding phase, frequency relationship of two waveforms using Lissajous figures.  
(c) What are the advantages of using an active probe. [6+6+4]
6. (a) Explain the two types of analog storage of oscilloscopes? [2×3=6]  
(b) What are the differences between Digital storage oscilloscope and conventional storage oscilloscope. [6]

- (c) A sampling oscilloscope is being used to observe a 400 MHz sine wave. A sampling pulse occurs every 3 ns. Draw five cycles of the 400 MHz signal and place a dot at the sampled point on each of the five cycles. [4]
7. (a) Show and explain the capacitive transducer arrangement to measure angular velocity and what are its limitations? [2+4+2=8]  
(b) What are the disadvantages of capacitive transducers? [4]  
(c) What are the uses of capacitive transducers? [4]
8. (a) With neat sketches and suitable equations explain the working of a capacitive transducer?  
(b) Explain the operation of a potentiometric transducer. [8+8]

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1. (a) What techniques are used to measure lower voltages either in a.c. or d.c.? Explain with examples.  
(b) What is the lowest full scale voltage that could be displayed with  $50\mu$  A meter movement with an internal resistance of  $100\Omega$  ? What would the sensitivity of this meter be in ohms per volt. Is there any way this meter could be used to construct a lower full scale voltage reading while measuring a.c. voltages. [8+8]
2. (a) A bridge has  $3300\ \Omega$  in one arm and its opposite arm has a capacitor of value  $0.47\mu$  F The arm to the right of resistor arm is having  $1500\ \Omega$  in shunt with a  $0.33\ \mu$  F The arm opposite to this arm is connected with the unknown component. Find the value of the component and its dissipation factor.  
(b) Discuss the bridge which is suitable for measuring the unknown value of the capacitor whose dissipation factor is less. [8+8]
3. (a) Explain various methods of measuring the impedance of a circuit using Q ? meter.  
(b) Explain the working principle of a Q meter. [8+8]
4. (a) Draw the block diagram of a decade counter interfaced with a seven-segment display and explain.  
(b) Explain briefly ripple binary coded decimal counter. [8+8]
5. (a) Draw the neat sketch of the CRT and explain the main components of it.  
(b) Explain the electrostatic Focusing used in all CROs. [10+6]
6. (a) Discuss the elements of a Tape Recorder.  
(b) Explain the direct recording method in detail. [8+8]
7. (a) Explain the working of a piezoelectric transducer with suitable equations and sketches.  
(b) Derive an expression for gauge factor for a strain gauge. [8+8]
8. (a) Show with an example, how the capacitive transducer has excellent frequency response? [8]

Code No: RR320403

**Set No. 2**

(b) What is temperature co-efficient of resistor? Explain in detail. [3+5=8]

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1. (a) What is meant by voltmeter sensitivity? Explain its relevance in circuit applications. What is meant by loading effect? What circuit arrangement is done to avoid the same.
- (b) It is desired to measure the voltage across the  $100\text{K}\Omega$  resistor in the circuit (figure 1b). Two voltmeters are available for this measurement. Voltmeter 1 with a sensitivity of  $1000\Omega/\text{V}$  and voltmeter 2 with a sensitivity of  $20,000\Omega/\text{V}$ . Both meters are used on their  $50\text{V}$  range. Calculate i) the reading of each meter ii) error in each reading, expressed as a percentage of the true value.

[8+8]

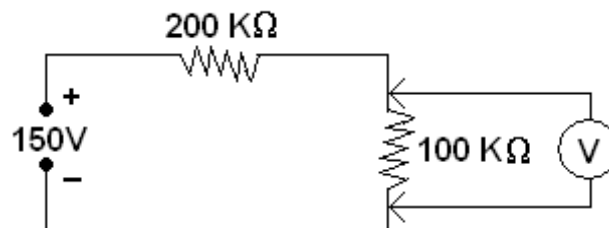


Figure 1b

2. The standard resistor arm of a Wheatstone bridge has a range from 0 to 100 ohm with a resolution of 0.001 ohm. The galvanometer has an internal resistance of 100 ohm and can be read to  $0.5\ \mu\text{A}$ . The other two arms have each 1 kohm. The bridge is supplied with a 10 V DC source. When the unknown resistance is 50 ohm, what is the resolution of the bridge in
  - (a) ohms and
  - (b) per cent of the unknown. [16]
3. (a) Draw a basic Q meter circuit and discuss how does this measure Q by direct connection method.
- (b) A coil with a resistance of 10 ohm is connected in the “direct measurement” mode. Resonance occurs when the oscillator frequency is 1 MHz and the value of capacitor is 65 pF. Calculate the percentage error introduced in the calculated value of Q by the 0.02 ohm insertion resistance. [10+6]
4. (a) Explain the block diagram of frequency counter with waveforms associated with the gating function of the frequency counter.

- (b) Explain the logic diagram of a time base of a frequency counter. [8+8]
5. (a) Explain the significance of the following Lissajous figures:
- i. Straight line
  - ii. Ellipse
  - iii. Circle.
- (b) Discuss the following display modes of dual-trace CRO:
- i. A and B chopped
  - ii. A and B Alternate.
- (c) An electrically deflected CRT has a final anode voltage of 2000V and parallel deflecting plates 1.5cm long and 5mm apart. If the screen is 50cm from the centre of deflecting plates. Find (a) beam speed (b) the deflection sensitivity of the tube and (c) the deflection factor of the tube. [6+4+6]
6. (a) Explain the two types of Spectrum Analyzers. [2×3=6]
- (b) Explain the following terms associated with Spectrum Analyzer: [3×2=6]
- i. Sensitivity
  - ii. Dynamic Range
  - iii. Harmonic Mixing.
- (c) Compare the selectivity characteristics of the Spectrum Analyzer and Wave Analyzer. [4]
7. (a) Explain piezoelectric effect. [4]
- (b) What are the materials that show piezoelectric effect? [4]
- (c) What are the materials belonging to natural and synthetic group of piezoelectric materials? [4]
- (d) Draw the structure of piezoelectric crystal. [4]
8. (a) Show with an example, how the capacitive transducer has excellent frequency response? [8]
- (b) What is temperature co-efficient of resistor? Explain in detail. [3+5=8]

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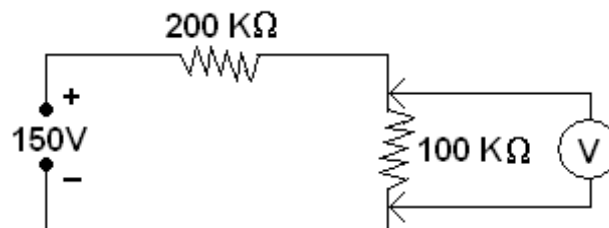


Figure 1b

2. The ratio arms of a Kelvin bridge are  $100\ \text{ohm}$  each. The galvanometer has an internal resistance of  $500\ \text{ohm}$  and a current sensitivity of  $200\ \text{mm}/\mu\text{A}$ . The unknown resistance is  $0.1002\ \text{ohm}$  and the standard resistance is set at  $0.1000\ \text{ohm}$ . A dc current of  $10\ \text{A}$  is passed through the standard and the unknown from a  $2.2\ \text{V}$  DC source in series with a rheostat. The resistance of the yoke may be neglected. Calculate:
  - (a) the deflection of the galvanometer and
  - (b) the resistance unbalance required to produce a galvanometer deflection of  $1\ \text{mm}$ .
3. (a) Discuss the problems associated in ac bridges if used for measurement at very high frequencies.
- (b) With circuit diagrams, explain the working of any two bridges that are employed for measurements at Radio frequencies.
4. (a) Explain the working of Variable frequency synthesizer.
- (b) Write the advantages of using direct synthesizer rather than indirect synthesizer.

[8+8]

[8+8]

[8+8]

5. (a) Derive the equations for Resistive voltage divider and capacitive voltage divider of compensated attenuator .
- (b) Explain the method of finding phase, frequency relationship of two waveforms using Lissajous figures.
- (c) What are the advantages of using an active probe. [6+6+4]
6. (a) What are the advantages and disadvantages of direct recording. [4+4=8]
- (b) Explain the following two terms in FM recording. [4+4=8]
- i. percentage deviation.
- ii. deviation ratio.
7. (a) What are the modes of operation of piezoelectric crystals? Explain in detail. [2+4=6]
- (b) Draw the equivalent circuit of piezoelectric transducer. [4]
- (c) Explain the properties of piezoelectric crystals. [6]
8. (a) Name some common types of strain gauges? [5]
- (b) What characteristics determine the size of the strain gauge? [5]
- (c) Explain the functioning of a foil type strain gauge. [6]

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