Roll No.:.......................

National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Branch	: ECE	Semester	:7TH
Title of the Course	:ELECTRONIC INSTRUMENTATION	Course Code	:EC-401

Time: 3 Hours   Maximum Marks: 50

SECTION-A (Attempt all, Each question carry 1 mark) $10 \times 1 = 10$ marks

1. The percentage limiting error in an instrument reading 8.3V and having guaranteed accuracy of 1% of the full scale reading and range of 0-150V is ?

2. A moving coil meter has 10Ω resistance and requires 40mA for full scale deflection. The shunt resistance required to convert it into 0-2A ammeter is ?

3. An LVDT is used to measure displacement. The LVDT feeds a voltmeter of 0-5V range through a 250 gain amplifier. For a displacement 0.5mm the output of LVDT is 2mV. The sensitivity of instrument is ?

4. The Lissajous pattern observed on screen of CRO is a straight line inclined at 45° to X axis. If X-plate input is $2\sin\omega$, the Y-plate input is ?

5. In figure 1. $Z_a = 100 \angle 50°$, $Z_b = 300 \angle -90°$ and $Z_c = 200 \angle 0°$. For balanced condition Z_d will be ?

fig 1.
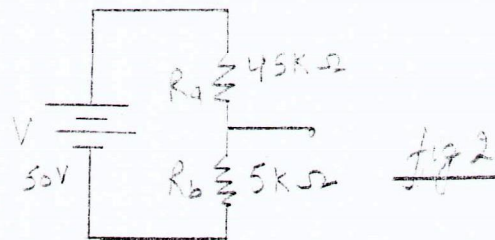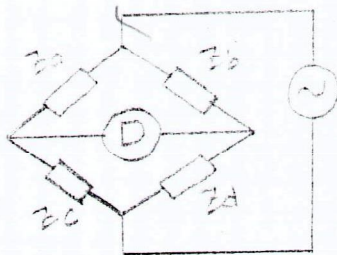
6. The resistance of a 125Ω strain gauge changes by 1Ω for 400 micro strain. The gauge factor is ?

7. A 0-200V voltmeter has an accuracy of 0.75% of full scale reading. If voltage measured is 100V, the % error is ?

8. A Lissajous pattern on an oscilloscope is stationary and has 5 horizontal tangencies and 2 vertical tangencies. The frequency of horizontal input is 1000Hz. Determine the frequency of vertical input.

9. How does a spectrum analyzer functionally differ a wave analyzer?

10. If the time/div control is set to 2µs/div, when the waveform displayed on the CRT screen covers 4 divisions, determine the frequency of the signal ?

SECTION-B (Attempt any four, Each Question carry 5 marks) $4 \times 5 = 20$ marks

11. (a) Describe with a diagram the construction of a concentric vane repulsion type movement. Explain the operation of a concentric vane repulsion type movement.   [3]

    (b) A moving instrument has the following data: no of turns=100, width of the coil=20mm, Depth of the coil=30mm, flux density in the gap=0.1Wb/m^2, the deflection torque=30×10^{-6}Nm. Calculate the current through the moving coil.   [2]

12. (a) Define terms 1) Accuracy 2) Resolution 3) Precision 4) Sensitivity 5) Expected Value   [2.5]

(b) For the following data, $x_1=49.7$, $x_2=50.1$, $x_3=50.2$, $x_4=49.6$, $x_5=49.7$. Calculate (i) Arithmetic mean (ii) Deviation of each value (iii) Algebric sum of the deviations (iv) Average Deviation (v) Standard Deviation

13. (a) Find the voltage reading and % error of each reading obtained with a voltmeter on (i) 5V range (ii) 10V range (iii) 30V range, if the instrument has a 20kΩ/V sensitivity and connected across Rb of figure 2.   [3]

(b) A shunt type ohmmeter uses a 10mA basic D' Arsonal movement with an internal resistance of 50Ω. The battery voltage is 3V. It is desired to modify the circuit by adding appropriate shunt resistance across the movement so that the instrument indicates 10Ω at the midpoint scale. Calculate (a) the value of shunt resistance Rsh (b) Value of current limiting resistance R1   [2]

14. (a) Explain with the help of a diagram and characteristics the operation of LVDT. Also explain the method of measuring displacement using LVDT.   [3]

(b) A capacitive tansducer uses two Quartz diaphragms of area 750mm² separated by a distance of 3.5mm. The capacitance is 370pF when no pressure is applied. A pressure of 900KN per m² when applied to top diaphragm produces a deflection of 0.6mm. Find the value of capacitance after applying pressure.   [2]

15. A sheet of 4.5mm thick Bakelite is tested at 50Hz between 12cm in diameter. The Schering bridge uses a standard air capacitor C_2 of 105pF capacitor, a non-reactive R4 of 1000/π in parallel with a variable capacitor and is obtained with C4=0.5μF and R3=260Ω. Calculate the capacitance, power factor and relative permittivity of the sheet.   [5]

SECTION-C (Attempt any two, Each Question carry 10 marks)   2 × 10 = 20marks

16. (a) Describe with a diagram and waveforms the operation of a dual trace CRO in alternate and chop mode. State the functions of each block.   [6]

(b) Estimate the Bandwidth of CRO, if signal of 12μs rise time is observed as the signal with 15μs rise time.[4]

17. (a) Describe the working principle of Heterodyne wave analyzer with the help of detailed block diagram. State the function of each block.   [6]

(b) Find the dynamic range of spectrum analyzer with a 30KHz, 3dB Bandwidth, a noise figure of 15dB and third order intercept of +25dBm.   [4]

18. (a) Explain with a diagram the operation of a Carry foster Bridge. Also derive the expression for measurement of unknown capacitance and inductance.   [6]

(b) Find the equivalent parallel resistance and Capacitance that causes Wien Bridge to null with the following components values: R1=3.1KΩ, C1=5.2μF, R2=25KΩ, F=2.5KHz and R4=100KΩ.   [4]