

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), November-December 2017

B. Tech in Electrical Engineering, Semester III

Roll No.....

Course Code: EE303 Measurement and Instrumentation Time: 3 hours Max. Marks: 100

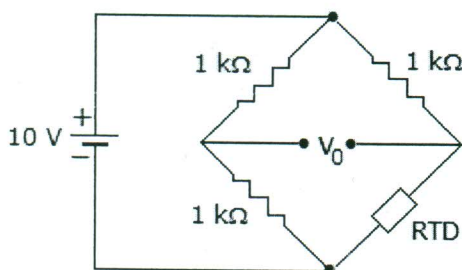
Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. The internal resistance for millie ammeter must be very low for:
(a) High sensitivity (b) High accuracy
(c) Maximum voltage drop across the meter
(d) Minimum voltage drop across the meter
- ii. If an inductance is connected in one arm of the bridge and resistances in the remaining three arms
(a) the bridge can always be balanced
(b) the bridge can't be balanced
(c) the bridge can be balanced if the resistance can have some specific value
(d) none of these
- iii. The output voltage of a thermocouple
(a) Remains constant with temperature (b) Decreases with applied voltage
(c) Increases with temperature (d) Increases with applied voltage
- iv. The response of a thermistor over the whole of its temperatures range is
(a) linear (b) non-linear (c) almost linear (d) either (a) or (c)
- v. Figure shows a Wheatstone bridge with RTD to one arm. If resistance of RTD = 1020Ω , the voltage V_0 is



- (a) 49 mV (b) 51 mV (c) 48 mV (d) 45 mV
- vi In a resistance strain gauge, $G = 2$, stress = 1050 kg/cm^2 , $R = 1000 \Omega$. The value of ΔR will be
(a) 2Ω (b) 3Ω (c) 4Ω (d) 1Ω

- vii The coil of a moving coil meter has 200 turns, is 40 mm long and 30 mm wide. The control torque is 240×10^{-6} N-m on full scale. If $B = 1$ Wb/m², range of meter is
 (a) 1 mA (b) 2 mA (c) 3 mA (d) 0.5 mA
- viii A standard cell of 1.0185 V is used with a slide wire potentiometer. The balance was obtained at 60 cm. When an unknown emf was connected, the balance was obtained at 82 cm. The magnitude of unknown emf is
 (a) 1.39 V (b) 0.75 V (c) 13.9 V (d) 7.45 V
- ix A moving iron voltmeter reads 250 V when connected to 250 V dc. If connected to 250 V 50 Hz, the voltmeter reading is likely to be
 (a) 250 V (b) 252 V (c) 248 V (d) 210 V
- x What will be the resolution of $4^{1/2}$ digit display on 100 V display range?
 (a) 0.001 (b) 0.0001 (c) 0.01 (d) 0.1

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- Why there is need of measurements? Explain the factors affecting the accuracy.
- Why the separate standard cell dial circuit is provided in modern dc potentiometer?
- Why do you need a multi-range ammeter and how can it built from a basic MC meter?
- Why is the volt ratio box needed? Explain working of voltage ratio box.

Q.3A Which are the main functional elements in measurement system? Explain. 05

Q.3B A digital voltmeter uses $4^{1/2}$ digit display (it can display up to 19999). It is used to measure a voltage across a standard cell whose value is 1.2341 volt 4 times and following readings are obtained: 1.2202, 1.2115, 1.2456, and 1.2218. Determine the accuracy, the precision and the bias of the voltmeter. 05

Q.4A Why are moving iron instruments commonly used for dc and ac quantity measurement? Explain the principle and working of moving iron instruments with suitable diagram. 05

Q.4B The change of the inductance for a moving iron ammeter is $2\mu\text{H}/\text{degree}$. The control spring constant is 5×10^{-7} N-m/degree. The maximum deflection of the pointer is 1000. What is the current corresponding to maximum deflection? 05

Q.5A How do you measure the unknown inductance using Anderson Bridge & also draw the phasor diagram? 05

Q.5B A Maxwell' Capacitance Bridge is used to measure an unknown inductance in comparison with capacitance. The various value at balance
 $R_2 = 1000 \Omega$, $R_3 = 1000 \Omega$, $R_4 = 1000 \Omega$ and $C_4 = 0.5\mu\text{F}$
 Calculate the value of R_1 and L_1 . Also calculate the value of Q if supply frequency is 100Hz. 05

Q.6A Why are the AC bridge most suitable for AC parameters measurement. Explain the source of supply and detectors are used in AC bridge circuit. 05

Q.6B State the feature of SAR type DVM over other DVMs. What are the advantage of SAR type DVM over other DVMs. 05

OR		
Q.6B	A 20 V DC voltage is measured by analog and digital multimeters. The analog instrument is on its 25 V range, and its specified accuracy is $\pm 2\%$. The digital meter has 3 $\frac{1}{2}$ digit display and an accuracy of $\pm (0.6\% \text{ of reading} + \text{a Digit})$. Determine the measurement accuracy in each case.	05
Q.7A	A thermistor has a resistance of 3980 ohm at the ice point (0°C) and 794 ohm at 50°C . The resistance temperature relationship is given by $R_T = aR_0 \exp (b/T)$. Calculate the constants a and b. Calculate the range of the resistance to be measured in case the temperature varies from 400°C to 1000°C .	05
Q.7B	Why is standardization of potentiometer necessary? Describe the procedure of standardization of a dc potentiometer.	05
OR		
Q.7B	Why is the earth resistance measurement necessary before earthing? What are the importance of earthing? Explain the factors influence the earth resistance.	05
Q.8A	Choose the most suitable temperature transducer with reason for measuring the temperature in each of the following (i) Rapidly changing temperature (ii) Very small temperature change about 40°C (iii) Very high temperature ($>1500^{\circ}\text{C}$) (iv) Highly accurate temperature measurement (v) Wide temp variation	10
Q.9A	Describe the operation and construction of strain gauge. Classified different type of strain gauge. How the gauge factor is change with change in the length, change in area and piezo resistive effect.	10
Q.9B	Explain with help of suitable diagram, how DC potentiometer can be used for: (i) Calibration of voltmeter. (ii) Calibration of ammeter. (iii) Measurement of resistance. (iv) Measurement of power. (v) Calibration of wattmeter.	10
OR		
Q.9B	A Crompton's type potentiometer has a 18 step dial switch where each step represent 0.1 V and resistance is $10\ \Omega$. The slide wire of potentiometer is circular and has 11 turns and a resistance of $11\ \Omega$. The slide wire has 100 divisions and interpolation can be done to one fourth of a division. The working battery has a voltage of 6.0 V and negligible internal resistance. Calculate (i) Total resistance of measuring circuit. (i) Measurement range. (ii) Resolution of the instrument. (iii) Working current. (iv) Setting of rheostat.	10