

Kafrelsheikh University
 Faculty of Engineering
 Department : Electrical Engineering
 Year: First Electrical (R-2007)
 Subject: Electrical instruments & Measurements
 Student name:



Final Exam of 2nd Semester 2017/2018
 Time allowed: 3 hours
 Full Marks : 90
 Exam Date: 23/05/2018
 Number of Pages: 2 Pages

Relationship between Course Intended learning outcomes (ILOs) and National Academic Reference Standards (NARS)

Field	National Academic Reference Standards (NARS)		
	Knowledge & Understanding	Intellectual Skills	Professional Skills
academic standards that the course contribute in achieving it	a.1, a.5	b.1, b.2,b.3	c.1, c.2, c.5

Attempt to solve the following problems as much as you can:

P-1	25 Marks
A (15)	a- What are the main differences between transducers and sensors? b- Briefly describe the Thermistors; resistance thermal detector and strain gauge. c- The time base signal in a CRO is d- Draw the block diagram of a CRO and explain the different components. e- Sketch and explain the basic principle of digital frequency and velocity meters? f- sketch and explain the Block diagram of a digital multimeter? g- The resistance of a thermistor is 800Ω at 50°C and $4 \text{ k}\Omega$ at the ice-point. The characteristic constants (A, B) for the thermistor and the variations in resistance between 30°C and 100°C are (Complete) h- In strain gauges. The Poisson's ratio and gauge factor are..... (Complete)
B (5)	Explain the basic requirements of a transducer?
C (5)	The output of an LVDT is connected to a 5 V voltmeter through an amplifier of amplification factor 250. The voltmeter scales 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 the core is displaced through a distance of 0.5 mm. Calculate: the sensitivity of the LVDT, that of the whole set up, and the resolution of the instrument in mm.
P-2	15 Marks
A (6)	<u>Mention in brief:</u> measurement concept, undesirable static characteristics of measuring instruments, calibration process?
B (9)	A voltmeter of 500Ω resistance and a milliammeter of 0.5Ω resistance are used to measure two unknown resistances by voltmeter–ammeter method. If the voltmeter reads 50 V and milliammeter reads 50 mA in both the cases, calculate the percentage error in the values of measured resistances for the following two cases: Case 1 , the voltmeter is put across the resistance and the milliammeter connected in series with the supply, Case 2 , the voltmeter is connected in the supply, side and milliammeter connected directly in series with the resistance. Give an alternative method for measuring the above resistance.

P-3	20 Marks
A (5)	<u>How do you perform the follows:</u> 1) Measuring the resistances. 2) Compensating the temperature in PMMC instruments. 3) Measuring the voltage across two parallel resistors. 4) Measuring the source frequency. 5) Compensating the ohmmeter internal battery voltage shortage.
B (5)	The power dissipated in a car headlight is calculated by measuring the d.c. voltage drop across it and the current flowing through it. If the possible errors in the measured voltage and current values are $\pm 5\%$ and $\pm 3\%$ respectively, Calculate the likely possible maximum and minimum error in the resistance and power value deduced.
C (10)	Design a multimeter of internal resistance is 100Ω with sensitivity of $2.5 \text{ k}\Omega/\text{V}$, contains: A voltmeter to measure ranges 0-5, 0-10, 0-20, and 0-50 volts, An ammeter to measure ranges 0-10 mA, 0-20 mA, 0-200 mA, and An ohmmeter measures the ranges 0-100 Ω , 0-250 Ω , 0-2000 Ω . Consider internal battery of 9 V.
P-4	15 Marks
A (5)	<u>Discuss</u> the dynamic behaviour of the permanent magnetic moving coil instruments.
B (10)	In the circuit shown in Figure 1, the current flowing between A and B is measured by an ammeter whose internal resistance is 100Ω . 1) What is the measurement error caused by the instrument resistance? 2) Plot the ammeter error versus the series ammeter resistance then obtain its value that optimize the instrument error. 3) If you want to measure the voltage between terminals AB, deduce the percentage error formula in terms of ameter error and internal resistance of voltmeter.
P-5	15 Marks
A (6)	Explain the differences between each of the following pairs: 1) PMMC and moving iron instruments. 2) Multi range ammeter & Multi range voltmeter instruments.
B (9)	For a Maxwell bridge, Consider $R_2=80 \Omega$, $R_1= 100 \Omega$, $R_3= 160 \Omega$, $C=25 \text{ mF}$ and Supply frequency is 50 Hz. The requirement is to derive an expression for R_u and L_u under balance conditions for the following cases then obtain with possible comments: 1) The RC in branch AD in parallel. 2) When RC elements are now in series. 3) Check the balance when the capacitor c is opened.
	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Figure 1</p> </div> <div style="text-align: center;"> <p>Figure 2: Maxwell bridge</p> </div> </div>

Best regards

Associate Prof. Dr. Ragab El Sehiemy & Assistant Prof. Dr. Bedir Yousif