Al-Mansoura University	First Year Students.
Faculty of Engineering	Time: 3 Hours
Department of Comm. & Electronics.	June 2014
Electronic Measurements (1), **COM 9123**	Total **100 Marks**

Attempt in all questions and assume any missing data.

Q1:(a)-For the following measurements data sets:

Data Set A:	24.3643	21.1894	23.2292	24.8344	23.3247
	24.3519	20.0496	20.6850	24.0938	22.1508.
Data Set B:	23.7683	23.9694	24.5998	24.2236	21.8388
	23.1040	23.6564	20.9695	24.5241	22.8460.

Calculate **mean**, **median**, **standard deviation** and **the variance** for each of the data set shown above. Which one is accurate? **(8 Marks)**

(b)-Three resistances have the following ratings: **R1 = 15 Ω ± 5 %; R2 = 33 Ω ±2 %; R3 = 75 Ω ± 5 %**. Determine the magnitude and limiting error in ohms, if the resistances are connected: 1-in **series**, 2-in **parallel**. Also obtain percentage relative limiting error in the resultant. **(8 Marks)**

Q2:(a)-A voltmeter having a sensitivity of **2 kΩ/V** reads **90 V** on its **150V** range, when connected across an unknown resistor in series with an ammeter. The ammeter resistance is **100 Ω** and reads **30 mA**. Calculate:
1-Apparent resistance. 2-Actual resistance of unknown resistor. 3-Error due to loading effect of voltmeter. 4-Percentage relative accuracy. **(8 Marks)**

(b)-Figure (1) shows a simple series circuit of **R1** and **R2** connected to a **250 V DC** source. If the voltage across **R2** is to be measured by the voltmeters having: 1-A sensitivity of **500 Ω/V**, 2-A sensitivity of **10,000 Ω/V**. Find which voltmeter will read more accurately. Both the meters are used on the **150 V** range. **(8 Marks)**

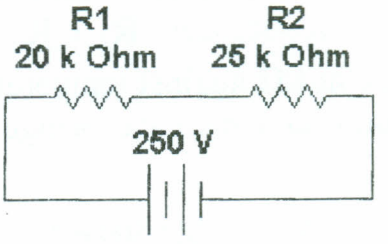

Figure (1)

Q3:(a)-A moving coil instrument gives a full scale deflection for a current of **20 mA** with a potential difference of **200 mV** across it. Calculate: 1-**Shunt resistor** required to use it as an ammeter to get a range of **0 - 200 A.**
2-Multiplier required to use it as a voltmeter of range **0-500 V**. **(8 Marks)**

(b)-A basic D'Arsonoval movement with an internal resistance of **50 Ω** and a full scale deflection current of **2 mA** is to be used as a multirange voltmeter. The voltage ranges are **0-10 V, 0-50V, 0-100 V, 0-500 V**. 1- Design the series string multipliers. 2- Design the individual multipliers. **(8 Marks)**

Q4:(a)-A D'Arsonval movement with an internal resistance of **730 Ω** and full scale current of **5mA** is available. A multirange ammeter with the ranges of **1A**, **5A**, and **25A** is employing: **1**-Derive an expression for **individual** shunts and

calculate its values. **(2)**- Derive an expression for **Aryton** shunts and calculate its values. **(8 Marks)**

(b)-A **50 Ω** basic movement requiring a full scale current of **1 mA** is to be used as an ohmmeter. The internal battery voltage is **3V**. A half scale deflection marking desired is **1 kΩ**. Calculate: 1-Values of **R1**, and **R2**. 2-Maximum value of **R2** to compensate for a **5 %** drop in battery voltage. **(8 Marks)**

Q5:(a)-The four arms of the Wheatstone bridge, shown in **Figure (2)**, have the following resistances; **AB = 1 kΩ, BC = 1 kΩ, CD = 120 Ω, and DA = 120 Ω.** The bridge is used for strain measurement and supplies from **5V** ideal battery. The galvanometer has sensitivity of **1 mm/μA** with internal resistance of **200 Ω**. Determine the deflection of the galvanometer if arm **DA** increases to **121 Ω** and arm **CD** decrease to **119 Ω**. **(9 Marks)**

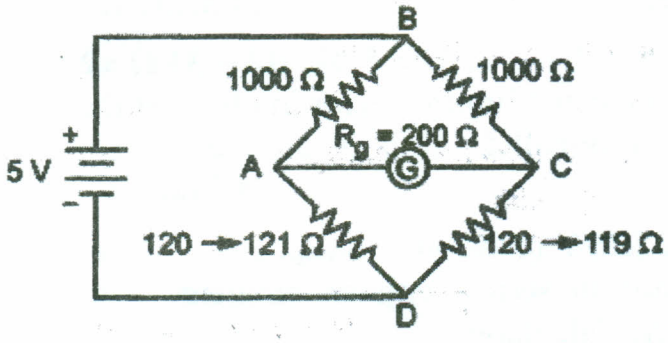

Figure (2)

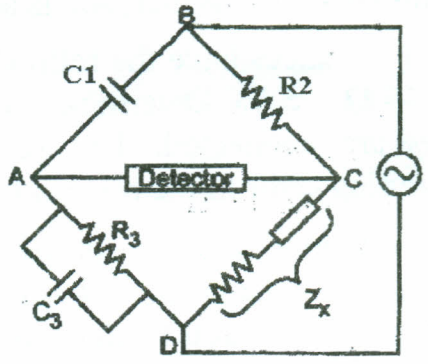

Figure (3)

(b)-The temperature dependent resistor is used in one arm of a Wheatstone bridge. The other resistances $R_1 = R_2 = R_3 = 6$ **kΩ** and **V = 10V**. The variation of resistance in **kΩ** against temperature is given by: $R = 2 + t/20$ **kΩ**. Calculate the temperature at which the bridge is balanced. Also calculate the error voltage at **55°C** and **95° C**. **(9 Marks)**

Q6:(a)-The **AC** bridge shown in **Figure (3)** is balanced at **1 kHz**. It has following components: $C_1 = 0.2\mu F$, $R_2 = 500\Omega$, $R_3 = 300\Omega$, and $C_3 = 0.1\mu F$. Derive an expression for the unknown impedance Find the value of Z_x. **(9 Marks)**

(b)-For the **Wien** bridge shown in **Figure (4)**, derive an expression for the frequency **f** of this bridge at a balance condition. Also find the equivalent parallel resistance and capacitance that causes a **Wien** bridge to null with the following component values: R_1 = **2.7 kΩ**, C_1 = **5 μF**, R_2 = **22 kΩ**, R_4 = **100 kΩ**. The operating frequency is **2.2 kHz**.

(9 Marks)

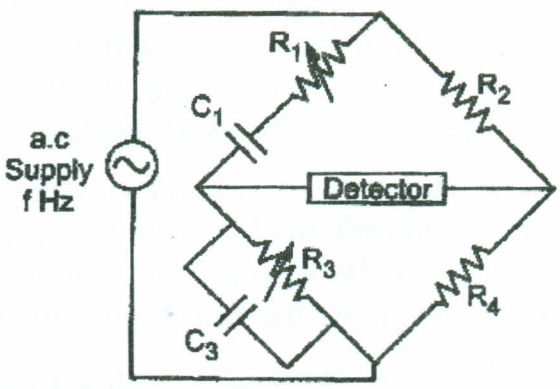

Figure (4)