Al-Mansoura University
Faculty of Engineering
Communications & Electronic Dept.

Time: 3 Hours.
Second Term Exam.
June 2012

Electronic Measurements (1)

Attempt in all questions and assume any missing data.

Q1: It is desired to measure the value of current in the 1kΩ resistor as shown in Figure (1), by connecting 50 Ω Ammeter. Calculate: 1- The actual value of current. 2- Measured value of current. 3- % Error and accuracy.

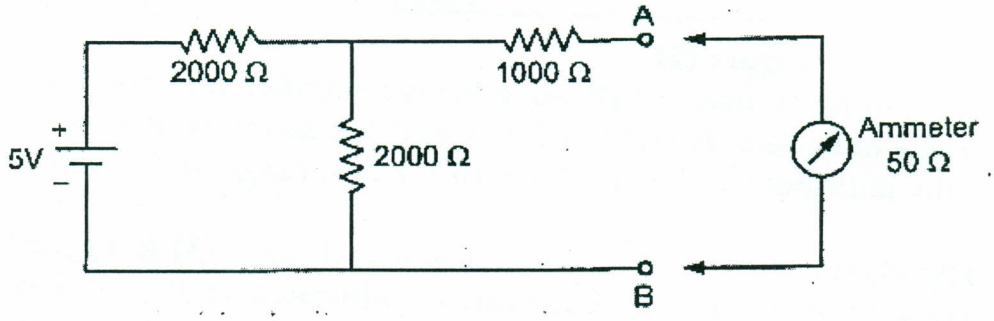

Figure (1)

Q2: A particular bridge gives the value of the unknown resistance as: $R_x = \frac{R_2 R_3}{R_1}$. The values of the known resistances are: $R_1 = 120 \pm 0.1\ \%\ \Omega$, $R_2 = 2700 \pm 0.5\%\ \Omega$, and $R_3 = 470 \pm 0.5\ \%\ \Omega$. Determine the magnitude of the unknown resistance and the limiting error in percent and in Ω for the unknown resistance R_x.

Q3: (a)- Explain with drawing the operation of the four range ammeters, and derive an expression for the multipliers.
(b)- Design a multirange DC milliammeter with a basic meter having a resistance 75 Ω and full scale deflection for the current of 2 mA. The required ranges are 0-10 mA, 0-50 mA and 0-100 mA.

Q4: (a)-Design an Aryton shunt to provide an ammeter with the current ranges 1A, 5A and 10 A. A basic meter resistance is 50 Ω and full scale deflection current is 1 mA.
(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. Design the series string of multipliers to obtain the voltage ranges of 0-10 V, 0-50V, 0-100 V, 0-500 V.

Q5: (a)- For the circuit of the instrument shown in Figure (2), name this instrument and explain its operation. How to solve the problem of the nonlinear behaviour of the diodes?

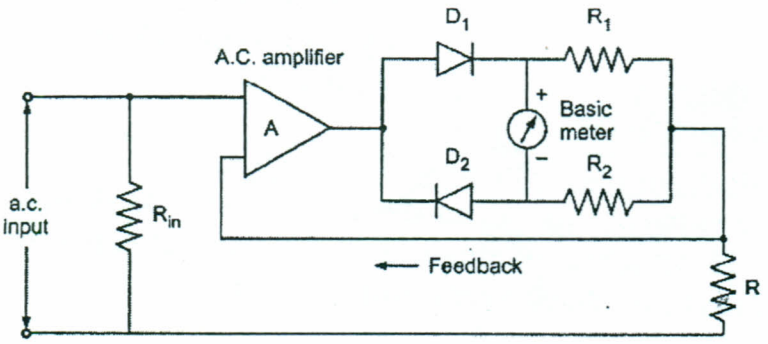

Figure (2)

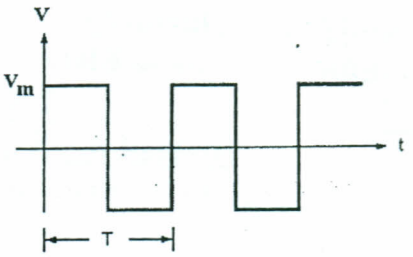

Figure (3)

(b)-An AC. voltmeter uses a full wave bridge rectifier and the basic meter with full scale deflection current of 2 mA and the meter resistance of 500 Ω. Calculate the multiplier resistance for a 10 V r.m.s. range on the voltmeter.

Q6: (a)-Tile symmetrical square wave shown in Figure (3) is applied to the average responding voltmeter. The scale is calibrated in terms of the r.m.s value of purely sinusoidal waveform. Calculate the form factor of square wave and the error in the meter reading.

(b)- Explain with drawing a true r.m.s. responding AC voltmeter instruments, and list its advantages.

Q7:(a)-Explain with drawing the Kelvin bridge and state the condition to eliminate the contact and lead resistance. Derive an expression for the unknown resistance R_x.

(b)- The temperature dependent resistor is used in one arm of a Wheatstone bridge. The other resistances are: $R_1 = 10k\Omega$, $R_2 = 10k\Omega$, $R_3 = 10k\Omega$ and V= 10V. Calculate the temperature at which the bridge is balanced. Also calculate the error voltage at 60^0 C. The variation of resistance against temperature is shown in Figure(4).

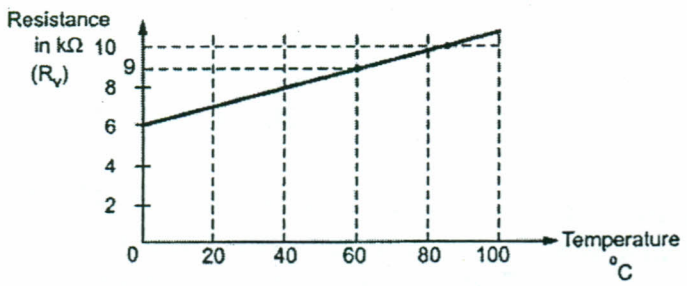

Figure (4)

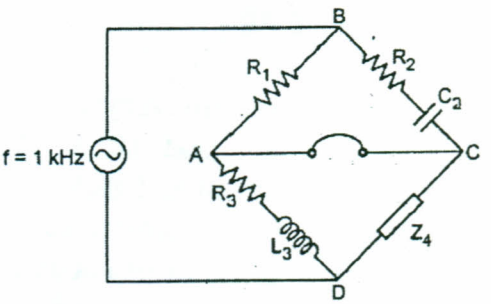

Figure (5)

Q8: (a) Explain with drawing the AC bridge and derive an expression of the balanced equation.

(b)- The basic AC bridge shown in Figure (5) consists of the following constants: $R_1 = 400\Omega$, $R_2 = 150\Omega$, $R_3 = 100\Omega$, $C_2 = 0.2\mu F$, and $L_3 = 10mH$. The source oscillator frequency is 1 kHz. Determine the impedance Z_4.

With My Best Wishes, Dr. M. Morsy.