Kafrelsheikh University
Faculty of Engineering
Department: Electrical Engineering
Year: First Electrical (R-2007)
Subject: Electrical instruments & Measurements
This exam measures the course ILOs

Final Exam of 2nd semester 2018/2019
Time allowed: 3 hours
Full Marks : 90
Exam Date: 3 /06/2019
Number of Pages: 2 Pages

Q1 (a1,a4,b1,b2, c1)	(18 M)

A. Give the limitations of thermistor and LVDT

B. State the purpose of a lissajous pattern in CRO.

C. In a CRT, the distance between the deflecting plates is 1.0 cm, the length of the deflecting plates is 4.5 cm and the distance of the screen from the centre of the deflecting plates is 33 cm. If the accelerating voltage supply is 300 volt, calculate deflecting sensitivity of the tube.

D. The coil of a measuring instrument has a resistance of 1 Ω and the instrument has a full scale deflection of 250 V when a resistance of 4999 Ω is connected with it. Find the current range of the instrument when used as an ammeter with the coil connected across a shunt of (1/499) Ω and the value of the shunt resistance for the instrument to give a full scale deflection of 50 A.

Q2 (a4,b1,b2,b3, c2,c5)	(18 M)

A. Sketch and explain the working forces of moving-coil instruments.

B. Distinguish between gross error, systematic error and random error with examples. What are the methods for their elimination/reduction?

C. A moving coil instrument whose resistance is 25Ω gives a full scale deflection with a current of 1mA. This instrument is to be used with a manganin shunt, to extent its range to 100mA. Calculate the error caused by a 100C rise in temperature when:
- Copper moving coil is connected directly across the manganin shunt.
- A 75 ohm manganin resistance is used in series with the instrument moving coil. The temperature co-efficient of copper is 0.004/0C and that of manganin is 0.000150/C.

Q3(a1,a4,b1,b2,b3,c1,c2,c5)	(18 M)

A. Sketch and explain the basic principle of digital frequency and Volt meters?

B. Design an Aryton shunt to provide an ammeter with current ranges of 1A, 5A, 10A and 20A. The full scale deflection current equals 1 mA and the meter internal resistance consumes 25 μWattes.

C. Choose the correct answer:

1) Which of the following is correct for Thermistors?
   a) Positive temperature coefficient of resistance   b) Negative temperature coefficient of resistance
   c) Unpredictable temperature coefficient   d) None of the mentioned

2) To the y input of a CRO a signal defined by 10sin100t is applied. To the x input the signal 10cos100t is fed. The gain for both x-channel and y-channel is the same. The screen shows
   a- a circle.   b- sinusoidal.   c- an ellipse.   d- a straight line.

2) The measurement of a quantity can be defined as:
   a- comparison of an unknown quantity with known quantity.
   b- comparison of an unknown quantity with another quantity.
   c- comparison of an unknown quantity with standard.

4- Electronic voltmeters are
   a) dependent of frequency   b) dependent of voltage
   c) independent of frequency d) dependent of current.

5- Loading effect in electronic voltmeters is
   a) nil   b) high   c) low   d) medium

6- A potentiometer may be used for
   (a) measurement of resistance   (b) measurement of current   (c) calibration of ammeter
   (d) calibration of voltmeter   (e) all of the above

7- Multimeter can be used as an ammeter by _____
   a) connecting series resistances   b) making use of a transducer
   c) making use of a transformer   d) connecting shunts.

8- The ratio of change in output to the change in the input is called
   a- precision   b- resolution
   c - sensitivity   d- repeatability

Q4 (a1,a4,b1, b3,c1, c5)	(18 M)

A. For the circuit of **Fig. 1**: a) Is the bridge balanced? b) Determine the current through R5.

B. The output of the voltage divider shown in **Fig. 2** is measured by voltmeters with internal resistances of 1,000 Ω and 20,000 Ω respectively. Find the reading of each voltmeter

C. 8- A strain gauge with a gauge factor equal to 2. and an unstrained resistance equal to R=100 Ω is used with a Wheatstone bridge transducer with R=100 Ω. calculate the longitudinal strain and the change in resistance of a strain gauge sensor if the output voltage, e_o= 121.95 mV and V_s= 10 V across the bridge.

Q 5(a1,a4,b1,b2,b3,c1,c2,c5)	(18 M)

A. What are the main advantages and disadvantages of PMMC instruments?

B. An output of 2 mV appears across the terminals of the LVDT when the core is displaced through a distance of 0.2 mm. Calculate the sensitivity and the resolution of the LVDT if the LVDT is connected directly to a 10 V voltmeter. The voltmeter scale has 100 divisions and its scale reads $1/4^{th}$ of a division.

C. Complete the following:

1- A CRO probe has an impedance of 500 kΩ in parallel with a capacitance of 10 pF. The measured voltage between P and Q as shown in **Fig. 3** will be ....

2- A voltmeter has 100 scale divisions and can measure up to 100 V. Each division can be read to ½ division. The resolution of the voltmeter is ....

3- A transducer measures a range of 0– 200 N force with a resolution of 0.15 % of full scale. The smallest change by this transducer equals ....

4- A metal with temperature coefficient of resistance has a value 200, its initial resistance is is 40 Ω. For increase from 30°c to 35°c, the final resistance value equals ....

5- In the bridge given in the **Fig. 4**, the reading of the high impedance voltmeter is ......

Fig. 1

Fig. 2

Fig. 3

Fig. 4
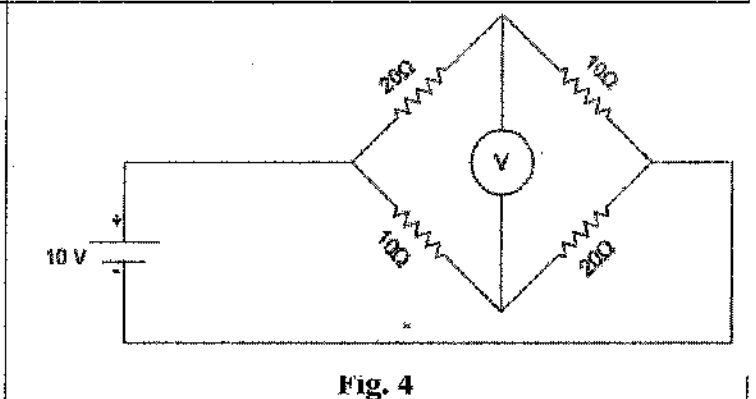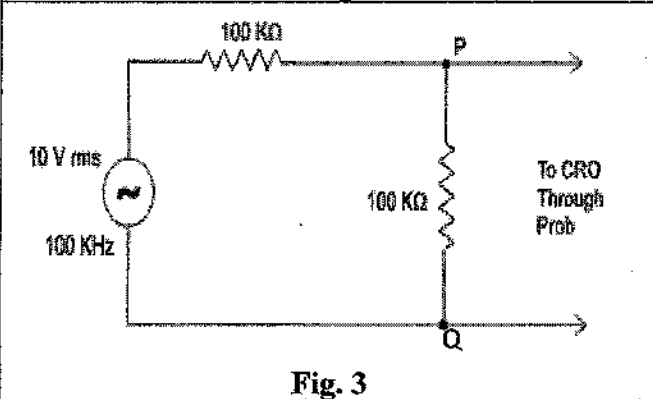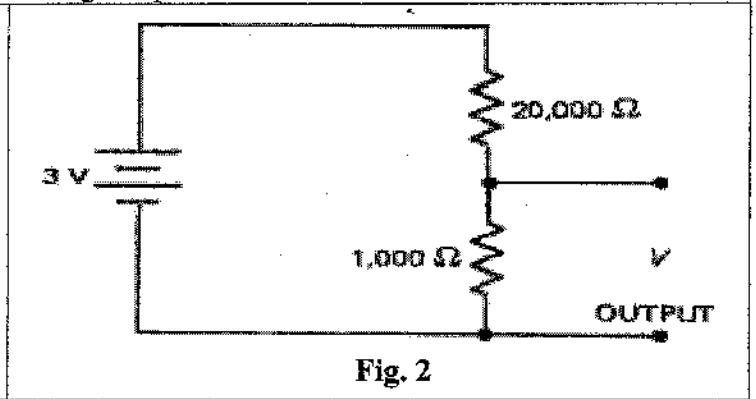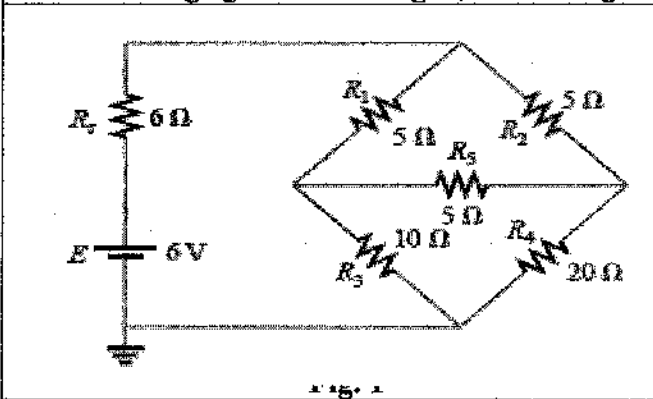
With best regards, Examiners team

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