

University of Technology-Electro-mechanical Engineering Dept.
Final Exam.2013-2014 sample (2)

Class: 2nd Year / *power*
Subject: Electrical Measurements & Devices
Lecturer: Nidhal Y. Nasser



Time: 3 Hrs
Date: 7/6/2014
Note: Answer five Questions

Name:

ID No.

Signature

Q1: A) A strain gauge is bounded to a beam 0.1 m long and has a cross-sectional area 4 cm². Young's modulus for steel is 207 GN/m². The strain gauge has an unstained resistance of 240 Ω and a gauge factor of 2.2. When a load is applied, the resistance of gauge changes by 0.013 Ω . Calculate the change in length of the steel beam and the amount of force applied to the beam. (5M)

B) A 250V, 10A dynamometer type wattmeter has resistances of current and potential coils of 0.5 and 1200 Ω respectively. Find the percentage error due to each of the two methods of connection when a 0.8 power factor lagging load of 4A at 220V, 50Hz supply. Draw the circuits and comment on the results. (5M)

C) How do you differentiate between accuracy and precision? (2M)

Q2: A) A set of independent current measurements were taken by six observers, and were recorded as 12.8A, 12.2A, 12.5A, 13.1A, 12.9A, and 12.4A. Calculate, (a) the arithmetic mean, (b) the deviations from the mean, (c) the average deviation, (d) the standard deviation, (e) the variance, (e) the probable error. (6M)

B) The output of a LVDT is 1.5V at maximum displacement. At load of 500K Ω , the deviation from linearity is maximum and it is $\pm 0.003V$ from the straight line through the origin. Find percent linearity at the given load? (3M)

C) Classify secondary instruments based on their function and give example on each. (3M)

Q3: A) A PMMC type full wave bridge rectifier ammeter is used to measure current in a load connected across a supply of two alternating voltages having the same frequency and phase and having the same value of maximum voltage (V_m) of 10V. One is sinusoidal and other is rectangular in waveform. Determine the reading on the ammeter, if its resistance is 40 Ω . Assume dynamic resistance of each diode as 20 Ω under forward biased condition. (6M)

B) Prove that the following equation is dimensionally correct.

$$C = \frac{1}{\omega^2 M} ; \text{ where, } C = \text{Capacitance, } \omega = \text{angular frequency } (2\pi f), M = \text{Mutual inductance.} \quad (6M)$$

Q4): A) In a Schering bridge; arm1 is a resistance of 1200 Ω shunted by a capacitor of 300pF capacitance, arm2; a resistance of 20000 Ω , arm3; a standard capacitor of 0.05 μ F capacitance, arm4; is an imperfect capacitor. All the resistors are a non inductive, the supply of 1 KHz is used to excite the bridge. Calculate; (a) the capacitance, (b) the equivalent series resistance, and (c) the dissipation factor of the imperfect capacitor. (6M)

B) Deduce the torque equation for a PMMC instrument and show its scale is linear. (4M)

C) If F.S.D of a multi meter is 50 μ A, what is its sensitivity in K Ω / V? (2M)

Q5): A) Explain the difference between balance conditions of DC and AC bridges. (3M)

B) what is SI system of units? State the fundamental and supplementary SI units. (3M)

Continued

C) A power transformer was tested to determine losses and efficiency. The input power was measured as 3650 W and the delivered output power was 3385 W, with each reading in doubt by ± 10 W. Calculate, (a) the percentage uncertainty in the losses ($P_i - P_o$) of the transformer; (b) the percentage uncertainty in the efficiency ($\frac{P_o}{P_i}$) of the transformer. (6M)

Q6: A) A PMMC instrument has a resistance of $100\ \Omega$ and full scale deflection current of $400\ \mu\text{A}$. a shunt arrangement is shown in figure (1) in order to have a multi range ammeters. Determine the various ranges to which may be switch. (Assume $R_1=R_2=R_3=R_4= 0.01\ \Omega$). (8M)

B) Classify the following transducers according to their application and method of energy conversion.

1) Velocity transducer; 2) strain gauge; 3) piezoelectric transducer; 4) bourdon tube. (4M)

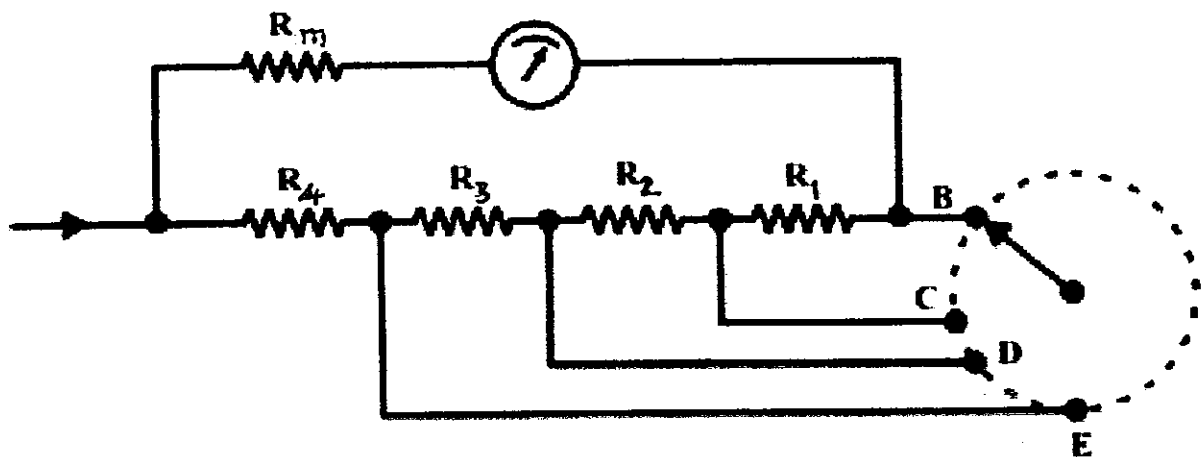


Figure (1)

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GOOD LUCK