

Mansoura University Faculty of Engineering Dept. of Power Mech. Eng. Course Title: Fine Measurements Course Code: MPE 3739		POST GRAD. STUDIES September 2013 Exam Type: Final Time: 3 Hours Full Mark: 100
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**Answer all the following questions.**

**Question (1)**

- a-** What is meant by readability and least count? [3 Marks]
- b-** A steel scale is graduated in increments of 1/32 in. What is the readability and least count of such a scale? [3 Marks]
- c-** Define time constant. [2 Marks]
- d-** A thermometer is initially at a temperature of 35 °C and is suddenly placed in a liquid which is maintained at 150 °C. The thermometer indicates 100 and 135 °C after time intervals of 3 and 5 seconds respectively. Estimate the time constant for the thermometer. [7 Marks]
- e-** Consider an ordinary mercury-in glass thermometer as a measurement system, and indicate which parts of the thermometer correspond to the generalized measurements system parts. [5 Marks]

**Question (2)**

- a-** What are the some purposes of uncertainty analysis? [4 Marks]
- b-** What are the causes and types of experimental errors? [3 Marks]
- c-** What is meant by the error analysis on a commonsense basis? [3 Marks]
- d-** A resistance arrangement of 50 Ω is desired. Two resistances of  $100.0 \pm 0.1 \Omega$  and two resistances of  $25.0 \pm .0.02 \Omega$  are available. Which should be used, a series arrangement with the 25 Ω resistors or a parallel arrangement with the 100 Ω resistors? Calculate the uncertainty for each arrangement. [10 Marks]

**Question (3)**

- a-** Describe the principle of operation of the Pirani gage. [4 Marks]
- b-** What are the advantages of the manometer pressure-measurement device? [4 Marks]
- c-** Describe the principle of operation of the Knudsen gage. [4 Marks]
- d-** A McLeod gage is available which has a bulb volume ( $V_b$ ) of 150 cm<sup>3</sup> and a capillary diameter of 0.3 mm. Calculate the gage reading for a pressure of 30 μm. [8 Marks]

**Question (4)**

- a- What is a Pitot tube? [3 Marks]
- b- Calculate the dynamic pressure measured by a Pitot tube in a flow stream of water moving at a velocity of 5 m/sec. [4 Marks]
- c- Describe in details one type of the positive –displacement methods for discharge measurements . [4 Marks]
- d- Describe the principle of operation of the turbine flow meter. [4 Marks]
- e- What are the advantages of the laser Doppler anemometer? [5 Marks]
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**Question (5)**

- a- Describe the bimetallic strip. [4 Marks]
- b- State the law of intermediate temperatures for thermocouples. [4 Marks]
- c- What is the Seebeck effect? [4 Marks]
- d- Describe the optical pyrometer. [8 Marks]
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أطيب التمنيات بالنجاح

*Prof. Dr. Hassan Mansour*