Menoufia University Faculty of Eng., Shebin El-Kom Mechanical Power Eng. Dept. Date of Exam: 12/01 / 2015		Measuring and Control Equipment Code: MPE 508 Year : Higher Diploma Time Allowed : 3 hours

Notes: a) Exam in two parts b) Answer each part in separate section

Part one

Question (1) (20 Marks)

1.1 Explain how can wind condition be measured by Biological Indicators method? (2 Marks)
1.2 Explain how can wind speed be measured by Eolian method? (1 Marks)
1.3 Explain with sketch the Propeller-type anemometer? (3 Marks)
1.4 Explain three different methods for recording wind speed in Cup-type anemometer? (3 Marks)
1.5 How can pressure tube anemometer be used for measuring wind speed? (3 Marks)
1.6 Why in pressure tube anemometer many numbers of perpendicular pair of tubes are required? (2 Marks)
1.7 How can laser anemometer be used for measuring wind speed? (3 Marks)
1.8 Explain with sketch how can the rotational movement of wind vane be transported to recording station and transformed to digital output? (3 Marks)

Question (2) (30 Marks)

2.1 What do you know about colour temperature charts? (3 Marks)
2.2 Explain why is the scale in liquid vapour filled system thermometers has wider graduations at higher temperatures and is cramped at the lower temperatures? (3 Marks)
2.3 Explain with sketch the operation of bimetallic strip for temperature measurement? How can the sensitivity of the bimetallic strip thermometers be increased? (3 Marks)
2.4 Drive an expression to determine the radius of curvature r of a bimetallic strip of two metals of equal thickness in the form of a cantilever of length L? (3 Marks)
2.5 What are the requirements of a conductor material to be used in electrical resistance thermometers? (3 Marks)
2.6 Explain with sketch how can platinum resistance thermometer be constructed? (3 Marks)
2.7 Explain with sketch the thermoelectric law of intermediate metals and its applications? (3 Marks)
2.8 Show with sketch how can the average temperature be measured by using thermopile? (3 Marks)
2.9 When is it necessary to use pyrometers for temperature measurement? What are their main types? (3 Marks)
2.10 Three similar thermocouples, the first measures between 20 and 150 °C and its emf was 6 mv, while the second measures between 150 and 300 °C and its emf was 8 mv. What will be the emf measured by the third if it measures between 20 and 300 °C (3 Marks)

End of part one, with best wishes Dr. A. A. El-Haroun

Part two

Question (3) (20 Marks)

3.1. Differentiate, with sketch, between: *i)* the systematic and random errors, ii) accuracy and precision. *(3 Marks)*

3.2. What is meant by active and passive transducers? Give suitable examples. *(3 Marks)*

3.3. Explain with neat sketch the different types of scale errors for a transducer. *(4 Marks)*

3.4. Select the most appropriate answer *(4 Marks)*

3.4.1. Inductive pressure transducers

i) have poor dynamic response *ii)* have high sensitivity

iii) are sensitive to vibrations *iv)* none of the above

3.4.2. A capillary tube when used for damping of pressure signals is called

i) low pass filter *ii)* high pass filter *iii)* acoustical filter *iv)* digital filter

3.5. A pressure measuring system uses a capillary tube 0.5 mm in diameter and 0.6 m long, connecting a pressure source to a transducer. At the transducer, there is a cavity 12 mm in diameter and 12 mm long. Air at a pressure of 1 bar and a temperature of 20° C is the pressure transmitting fluid. Calculate the phase angle for the pressure signal of 30 Hz and the pressure amplitude ratio. (Take the dynamic viscosity as 19.1×10^{-6} kg/m-s and gas constant R=287 J/kg-K). *(6 Marks)*

Question (4) (30 Marks)

4.1. Describe the following: *(4 Marks)*

i) alias frequency *ii)* data acquisition *iii)* signal conditioning filters *iv)* signal conditioning amplifiers.

4.2. Explain the operational theory, advantages, and disadvantages of piezoelectric transducers. Why it is limited to dynamic measurements? *(4 Marks)*

4.3. Describe the use of photoelectric transducers for measurement of pressure. Describe their advantages and disadvantages. *(4 Marks)*

4.4. Explain with sketch the operation of one device used to measure vacuum pressure. *(3 Marks)*

4.5. Explain the folding diagram for alias frequency. *(3 Marks)*

4.6. Explain the idea of operation of Lidar devices. *(3 Marks)*

4.7. Which device provides higher accuracy, Sodar or Lidar? Why? *(2 Marks)*

4.8. Describe the criteria that should be considered for the reconstruction of a measured waveform from a discrete signal. *(2 Marks)*

4.9. A 60 Hz sine wave is sampled at 75 Hz. Compute the maximum frequency that can be represented in the resulting discrete signal. Compute the alias frequency. Comment on the results. *(5 Marks)*

With best wishes

This exam measures the following ILOs			
Question No	Knowledge &Understanding Skills	Intellectual Skills	Professional Skills
1	KU1, KU3, KU5	I1, I5, I6	PP1, PP5
2	KU3, KU5	I1, I5, I6	PP1, PP5
3	KU1	I2, I6	PP1
4	KU1	I1, I6	PP1