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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015**

COURSE NAME : SENSOR AND TRANSDUCER
COURSE CODE : BWC 31303
PROGRAMME : 3 BWC
EXAMINATION DATE : JUNE 2015 / JULY 2015
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES

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- Q1** (a) Differentiate between,
- (i) threshold and resolution
 - (ii) accuracy and precision
- (8 Marks)
- (b) Describe the types of errors in measurements. Give their causes and remedies.
- (12 Marks)
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- Q2** (a) Explain about calibration process of a transducer.
- (4 marks)
- (b) State and explain any three desirable static and dynamic characteristics of an instrument.
- (6 marks)
- (c) Clasify five transducer based on different transduction principles.
- (10 marks)
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- Q3** (a) (i) State the principle of strain gauge which include gauge factor.
- (ii) Show and describe different types of strain gauges.
- (9 marks)
- (b) Illustrate and explain the principle of inductive transducers for displacement measurement. State its advantages and disadvantages.
- (11 marks)
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- Q4** (a) The quartz crystal microbalance technique is based on shear oscillations generated by a quartz crystal for sensor purposes.
- (i) Calculate the penetration depth of these oscillations for the fundamental frequency, 3rd and 5th overtones of typical crystal. Given the thickness is 0.5 mm and density of quartz is $2.65 \times 10^3 \text{ kg/m}^3$.
- (10 marks)

- (ii) Calculate which overtone is more sensitive to the adsorption of a 10 nm thin protein film with a density of 1050 kg/m^3 . (6 marks)
- (b) Explain four factors responsible in selecting of a transducer. (4 marks)
- Q5** (a) State three principles of inductance transducer. (3 marks)
- (b) Illustrate a biosensor in a block diagram. (5 marks)
- (c) Describe three properties of smart sensors. (6 marks)
- (d) State three characteristics of smart sensor as compared to conventional sensor. (6 marks)

- END OF QUESTION -