MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF EDUCATION (SCIENCE)

SPH 442: INSTRUMENTATION SYSTEMS

DATE: 29/4/2019 **TIME: 8.30-10.30 AM**

INSTRUCTIONS TO CANDIDATES

Answer Question **ONE** in **section A** and Any Other **TWO** Questions in **section B.**

SECTION A (COMPULSORY)

QUESTION ONE (30 MARKS)

a) By use of an example, distinguish between sensor and transducer (4 marks)

b) Define the following terms as commonly used in instrumentation systems (3 marks)

i. Reliability

ii. Accuracy

iii. Precision

c) Give the measurable physical quantities in the following energy types: (4 marks)

i. Mechanical

ii. Thermal

iii. Electrical

iv. Magnetic

d) State any four advantages of digital multimeters in measurement (4 marks)

e) How will one know that an instrument is accurate? (2 marks)

f) Outline the major components of a measurement system? (4 marks)

g) Every measurement that is made is subject to a number of errors. By use of an example, explain any three sources of errors in instruments. How are they eliminated? (6 marks)

h) State three useful applications of Micro-Electro-Mechanical Systems (MEMS) (3 marks)

QUESTION TWO (20 MARKS)

a) State ideal characteristics of an ideal operational amplifier (4 marks)

b) Light Dependent Resistor, LDR, are used in street lamps, camera light meters, alarm clock, burglar alarm circuits, light intensity meters, and counting packages moving on a conveyor belt. Explain how LDR are used in: (10 marks)

i. Street lamps,
ii. Camera
iii. Light meters
iv. Burglar alarm circuits
v. Counting packages moving on a conveyor belt

c) Investment in instrumentation systems for robotics and artificial intelligence applications should be enhanced in a developing country like Kenya. In view of the current security status within Kenya and Africa as a whole, discuss the need for investing in robotics and artificial intelligence technologies (6 marks)

QUESTION THREE (20 MARKS)

a) State any three advantages of the fiber optics sensor (3 marks)

b) With illustrations, discuss the major types of proximity sensors (6 marks)

c) Use a diagram to explain the principle of operation of any one transducer for temperature (5 marks)

d) Depending upon function, infrared sensors are grouped as thermal and quantum. What are the differences between these two types? (6 marks)

QUESTION FOUR (20 MARKS)

a) Explain the following characteristics (4 marks)

i. Sensitivity

ii. Resolution

iii. Hysteresis

iv. Wear and aging

b) Think of a typical analogue oscilloscope as an instrument of choice and sketch its corresponding measurement systems. Show physical quantities, forms of energies components receive/produce, and major parts (16 marks)

QUESTION FIVE (20 MARKS)

a) In order to overcome inertia of the moving system of an indicating instrument, a damping torque is developed using a damping device attached to the moving system. By use a diagram, explain three damping conditions depicted by indicating instruments (12 marks)

b) Damping torque is produced by various methods. Discuss four major methods (8 marks)