MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF EDUCATION (SCIENCE)

SPH 442: INSTRUMENTATION SYSTEMS

DATE: 5/12/2017 **TIME:8.30-10.30 AM**

INSTRUCTION TO CANDIDATES:

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

SECTION A (COMPULSORY)

QUESTION ONE (30 MARKS)

a) What is electronic instrumentation? (1 mark)

ii. State the four components of a measurement system (2 marks)

iii. By use of an example, distinguish between sensor and transducer (3 marks)

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

i. Mechanical

ii. Thermal

iii. Electrical

iv. Magnetic

c) Discuss two characteristics of electronic instruments compared to mechanical or electrical ones (2 marks)

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

i. Reliability

ii. Accuracy

iii. Precision

e) State two examples of transducers (2 marks)

f) i. List two types of Analogue to Digital converters (2 marks)

ii. Outline two types of Digital to Analogue converters (2 marks)

g) i) What is signal conditioning (2 marks)

ii) State any three characteristics of typical analog systems (3 marks)

h) State four useful applications of Micro-Electro-Mechanical Systems (MEMS) (4 marks)

QUESTION TWO (20 MARKS)

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

b) By use of an example, explain any three sources of errors in instruments. How are they eliminated? (6 marks)

c) 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

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 any electronic 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)

Rotary encoders are divided into two, namely incremental and absolute. Discuss, with the aid of diagrams, these encoders in terms of their:

i. Differences (8 marks)

ii. Limitations (6 marks)

iii. Applications (6 marks)