



# MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)  
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF  
SCIENCE IN POPULATION HEALTH

INSTRUMENTATION SYSTEMS

DATE:

TIME:

SPH 442:

**INSTRUCTIONS. Answer Question One and Any Other Two Questions**

## QUESTION 1 (30 MARKS)

- Define measurement and explain the occurrence of a measurement error. (2 marks)
- Discuss the statistical characteristics of a measurement system (2 marks)
- Explain giving relevant example the principle of operation of piezoelectric and piezoelectric transducer (5 marks)
- Describe the principle of operation of a Wheatstone bridge (4 marks)
- Explain the functions of the essential components of a cathode ray oscilloscope (4 marks)
- Describe the working principle of a moving-coil instrument (4 marks)
- State and explain any three minor movements of a robot (3 marks)
- Distinguish between accuracy and precision of a measuring instrument (2 marks)
- State and explain any two branches of artificial intelligence (2 marks)
- Differentiate between non-servo and servo robots (2 marks)

**QUESTION 2 (20 MARKS)**

- a) Specific characteristics of any measurement instrument can be categorised into dynamic, static and random characteristics. Explain the meaning of each (3 marks)
- b) Discuss any five specification items that can be categorised as static characteristics (5 marks)
- c) Discuss any four specification items that are categorized as dynamic characteristics (4 marks)
- d) State and explain in details the three categories of errors in a measurement instruments (8 marks)

**QUESTION 3 (20 MARKS)**

- a) Define the term transducer and explain the difference between active and passive types of transducers giving examples in each case (5 marks)
- b) Explain the main function of a transducer in a measurement system (3 marks)
- c) Using a schematic circuit diagram explain how LVDT is used to measure small distances (5 marks)
- d) Calculate the resistance of platinum type thermostat of 523K. if its resistance was measured as 1050 ohms at 300K. given that the temperature coefficient of resistance for platinum is 0.00385 (4 marks)
- e) Explain the working mechanism of Capacitor microphones (3 marks)

**QUESTION 4 (20 MARKS)**

- a) Define the term robot and actuator (2 marks)
- b) State and explain the five main components of a robot (10 marks)
- c) Describe term servo mechanism and explain how automobile powered steering apparatus works based on this principle (5 marks)
- d) Differentiate between open loop and closed loop system (use an schematic diagram in each case) (3 marks)

**QUESTION 5 (20 MARKS)**

- a) Distinguish between analogue and digital signals (2 marks)
- b) Explain the operations of a successive approximation analogue to digital converter (6 marks)

- c) Using a schematic circuit diagram of 4 bit R-2R ladder network of a digital to analogue converter (6 marks)
- d) Discuss the principle of operation of any two mechanical chart recording instrument (6 marks)