



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (ENERGY ENGINEERING)

SET 313: MEASUREMENT AND INSTRUMENTATION

DATE: Thursday 8th December 2011

TIME: 2.00p.m – 4.00p.m

INSTRUCTIONS

Answer any THREE questions.

ALL questions carry equal marks.

Use clear and neat sketches

1. a) In a generalized measurement system distinguish between:
 - i) Basic fundamental elements and (3 marks)
 - ii) Auxiliary elements (2 marks)
- b) Draw a schematic diagram showing the basic and functional elements of a measurement system together. (5 marks)
- c)
 - i) Explain, with the aid of a sketch and block diagram how a Bourdon tube pressure gauge operates and identify the functional elements (5 marks)
 - iii) By using a linear variable differential transducer (LVDT) show how the performance of this pressure measuring device can be improved (5 marks)
2. a) List ten desirable characteristics that a transducer element should have when selecting a transducer for a particular application. (10mks)
- b) The output of a transducer element is usually too small to operate an indicator or recorder. Therefore, it is suitably processed and modified in the signal conditioning element so as to obtain the output in the desired form. List at least Five signal conditioning operations that can be carried out on the transduced information. (5 marks)
- c) The data presentation element gathers the output of the signal conditioning element and presents the same to be read or seen by the experimenter. List three important characteristic it should have.
Give two examples of data presentation elements. (5 marks)
3. a)
 - i) Distinguish between Analogue and Digital meters and list advantages and disadvantages of each. (5 marks)

- ii) Explain, with the aid of a sketch, how analogue-to-digital conversion is carried out. **(5 marks)**
- b) Briefly describe with the aid of sketches
- A digital computer system
 - how a digital computer may be used for the measurement and control of a process involving several input signals e.g. temperature, pressure etc that are analogue in nature **(5 marks)**
4. a) i) Define the term "Error" as used in measurement systems **(2 marks)**
- ii) Briefly discuss 'Errors' under the following **three** subheadings giving at least three examples for each based on the causes of these errors:
- Systematic or Cumulative Errors;
 - Accidental or Random Errors;
 - Miscellaneous Type of Gross Errors **(12 marks)**
- b) i) A voltmeter with internal resistance of $200\text{K}\Omega$ is connected across an unknown resistance. It reads 250V and the milliammeter (with very small internal resistance) connected in series with the same resistance reads 10mA. Determine the apparent resistance; actual resistance and the loading error due to loading effect of the voltmeter. **(4 marks)**
- ii) If the same voltmeter and milliammeter when connected with another unknown resistance read 100V and 2A respectively, determine the loading error in this case. **(2 marks)**
5. With the aid of a sketch give a brief description of any one device you could use to measure the following , explaining how they operate:-
- Pressure measurement **(5 marks)**
 - Temperature measurement **(5 marks)**
 - Flow measurement **(5 marks)**
 - Force or Torque or Mass or Strain measurement **(5 marks)**