



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EEE 414: INSTRUMENTATION

DATE:

TIME:

INSTRUCTIONS:

This paper consists of FIVE Questions.

Answer Question ONE [30 Marks] and any other TWO Questions [20 Marks Each].

Write your college number on the answer sheet.

This paper consists of 3 printed pages

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

QUESTION ONE (compulsory) (30 marks)

- a) Explain briefly the basic element of measuring instruments (3 marks)
- b) Distinguish between intelligent and dumb instruments (2 marks)
- c) Remote sensing techniques is one of the advance technologies in data acquisition. What are the possible mean of transmitting its data to the respected servers for further analysis and broadcast Explain their merits and demerits for each media? (5 marks)
- d) Outline the characteristic of an instrumentation amplifier as one of the device used in amplifying low level signal hence explain how its achieved (4 marks)
- e) Data acquisition through sensor undergoes various stages of processing. Explain what happens at signal conditioning stage (3 marks)
- f) Briefly explain any four techniques devised for reducing measurement noise. (4 marks)

- g) Explain the principle of temperature measurement using thermocouple device. (4 marks)
- h) Why do we filter the signal? Explain the mechanism of signal lock, sampling; quantization; de-quantization; anti-aliasing effect. (5 marks)

QUESTION TWO (20 MARKS)

- a) Discuss various factors that an Engineer could settle on before procuring an instrument for defined purpose (8 marks)
- b) The data captured through sensor is of low-level signal. Describe the mechanism involved in enhancing it for further analysis. What's the recommended device that does the job? Explain its requirement to meet the specific requirement that's attributed for its selection. (8 marks)
- c) Engineering field is quite diversified and production units in our industry are scaled such that different sensing systems are manufactured to aid their operations. To have optimal and steady function in data acquisition, explain briefly the devised criteria that's been used in their selection. (4 marks)

QUESTION THREE (20 MARKS)

- a) ADC and DAC systems are interfaced with a simple sample hold circuit for a complete enhancement during conversion. Illustrate a S/H circuit, hence state some of its functional performance parametric characteristics, advantages and application (8 marks)
- b) Calibration for any manufactured instrument is quite vital and it's good for such information to be reference with existing standards for the purpose of confirmative. Explain the nature of information that is retained in the calibration chain. (4 marks)
- c) Measuring instruments in most cases are not 100% efficient. We always incur errors of different versions. Explain four devised mechanisms that Engineers have invented to countermeasure in reducing system error. (8 marks)

QUESTION FOUR (20 MARKS)

- a) Prevention is always better than cure, and much can be done to reduce the level of measurement noise. Describe the appropriate steps that have been devised in designing the measurement system to reduce the noise. (5 marks)
- b) Explain the principle involved in measuring low quantities for the following: (15 marks)

QUESTION FIVE (20MARKS)

- a) Interfacing from acquisition system is done into two ways asynchronous and synchronous. Distinguish between the two. (2 marks)
- b) Explain two types of ports used in interfacing. (2 marks)
- c) Describe the principle of serial interface DCE and DTE hence enlist the benefits of USB. (9 marks)
- d) Explain the logical operation of USB between HUB and HOST and the elements of data supervisory system used in automation. (7 marks)