



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS  
2021/2022 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER EXAMINATIONS**

**FOR THE BACHELOR OF SCIENCE  
IN  
MECHANICAL AND INDUSTRIAL ENGINEERING**

**COURSE CODE: MIE 352**

**COURSE TITLE: METROLOGY**

**DATE: 20<sup>th</sup> April 2022**

**TIME: 12.00-2.00 p.m**

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**INSTRUCTIONS TO CANDIDATES**

Question ONE (1) is compulsory  
Answer Any Other TWO (2) questions

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

**QUESTION ONE****(30 marks)**

- a) Briefly describe what you understand by the term “measurement” **(2marks)**
- b) What are the two (2) important requirements for measurement? **(2 marks)**
- c) Explain the role of the following elements of a generalized measurement system **(6 marks)**
- i Primary sensing element
  - ii Variable conversion element
  - iii Variable manipulation element
- d) Describe how you select slip gauges for the required dimension **(3 marks)**
- e) List any three(3) characteristics of a good comparator **(3 marks)**
- f) What are limit gauges? **(2 mark)**
- g) Explain the following terms in measurement **(5 marks)**
- i Sensitivity
  - ii Resolution
  - iii Accuracy
  - iv Precision
  - v Correction
- h) List three (3) methods of measuring surface finish **(3 marks)**
- i) With reference to interferometry, explain the difference between constructive and destructive interference **(4 marks)**

**QUESTION TWO****(20 marks)**

- a) With the aid of a diagram, explain the operation principle of a dial indicator **(6 marks)**
- b) Discuss any three design requirements of a sine bar that to be observed in order for the angular measurement using a sine bar to be achieved **(6 marks)**
- b) Explain the following methods of measurement **(8 marks)**
- I. Method of measurement by transposition
  - II. Method of differential measurement
  - III. Method of measurement by complement
  - IV. Method of combination measurement closed series

**QUESTION THREE****(20 marks)**

- a) With the aid of a diagram, explain the operation principle of a Michelson Interferometer **(6 marks)**
- b) With the aid of a diagram, briefly describe how an autocollimator works **(6 marks)**
- b) Differentiate between the following categories of measuring instruments **(8 marks)**
- i Deflection and null type instruments
  - ii Analog and digital instruments
  - iii Mechanical and Electronic
  - iv Automatic and manually operated instruments

**QUESTION FOUR**

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**(20 marks)**

- a) In factory or production setups, why do you think measurement is necessary? **(5 marks)**
- b) Discuss the types of errors under the following categories **(9 marks)**
- i Errors of measurement
  - ii Errors of observation
  - iii Instrumental errors
- c) Explain six (6) types of limit gauges used for gauging internal diameters of holes **(6 marks)**