




ELIZADE UNIVERSITY, ILARA-MOKIN,
ONDO STATE, NIGERIA
DEPARTMENT OF
MECHANICAL, AUTOMOTIVE AND PRODUCTION
ENGINEERING

SECOND SEMESTER EXAMINATIONS
2016/2017 ACEDMIC SESSION

COURSE: MEE 308 – Metrology (2 Units)
CLASS: 300 Level Mechanical and Automotive Engineering
TIME ALLOWED: 2 Hours 30 Minutes
INSTRUCTIONS: Answer ANY FOUR questions of your choice


HOD'S SIGNATURE

Date: July/August, 2017

Question 1

- (a) Differentiate between Accuracy and Precision (3 marks)
(b) Define the following terms (2 marks)
(i) Readability (ii) Repeatability (iii) Reproducibility (iv) Drift
(c) State the mathematical expressions of:
(i) Error in Measurement (ii) Absolute Error (iii) Relative Error (iv) Percentile Error (4marks)
(3 marks)
(d) Explain the wringing of slip gauges (3 marks)
(e) Define Calibration and describe the standard procedure of calibrating a metrological instrument (3 marks)

Question 2

- (a). Discuss the precautions to be taken while measuring with a Vernier caliper to minimize errors and briefly describe the function of a ratchet stop in the case of a micrometer (3marks)
(b). Write short notes on the following terms (2 marks)
(i) Straightness (ii) Flatness (iii) Parallelism (iv) Roundness (2marks)
(c) Distinguish between alignment test and performance test in a machine tool (3marks)
(d). List three basic things required for a measurement to be meaningful (3marks)
(e). Explain using a sketch the functional elements of a generalized measurement System (5marks)

Question 3

- (a) Discuss the typical output characteristics of a force measurement system (2marks)
(b). Write short notes on Force and Load sensors and state the common technologies with which they work (3 marks)
(c). State and explain the operation of a typical load cell application with a neat sketch (3marks)
(d). List and explain 5 different device components normally involved in a torque sensor (5marks)
(e). Differentiate between reaction and rotary torque sensors (2 marks)

Question 4

- (a). Describe a basic Vibration Measurement system with the aid of a detailed sketch (5marks)
- (b). Explain briefly what shakers, and vibration-and-shock testing equipment are, and for what they are used. (3marks)
- (c). Identify any mechanical analog pressure measurement device of your choice and briefly describe its working principle with a sketch. State its advantages and limitations. (5marks)
- (d). Explain the principle of operation of a tyre pressure monitoring system (2marks)

Question 5

- (a). Briefly explain the principle of operation of a pyrometer and state the major advantages (4marks)
- (b). Explain what a strain gauge is and describe the principle with which it works with (3marks)
- (c). Derive the relationship between resistance, R and strain to indicate the gauge factor, GF [from $R=\rho L/A$ to $(\Delta R/R = GF\epsilon_a)$ (4marks)
- (d). Discuss the principle of operation of a venturi tube for flow measurement with the aid of a well labelled sketch and state the advantages and its limitations. (4marks)

Question 6

- (a). Explain the following terms (i) Limits (ii) Tolerance (iii) Interchangeability (iv) Fits (v) selective assembly (5marks)
- (b). Discuss the two systems of writing tolerances with suitable examples (2marks)
- (c). State and explain the three types of fits with the aid of a well labelled diagram (4marks)
- (d). Briefly explain the two ways of solving assembly process in the case of interference fits (4marks)