



FNU FIJI NATIONAL UNIVERSITY

College of Engineering, Science and Technology (CEST)
School of Electrical & Electronic Engineering

BACHELOR OF ENGINEERING (ELECTRICAL & ELECTRONICS), YEAR 4

EEE798 – INDUSTRIAL INSTRUMENTATION & MEASUREMENT II

FINAL EXAMINATION - SEMESTER I

DAY/DATE: JUNE 2018. TIME: 9:00pm - 12:10pm.

INSTRUCTIONS TO CANDIDATES:

1. You are allowed 10 minutes Extra reading time during which you are NOT to write.
2. Begin each question on a fresh page and use both sides of the sheet.
3. Write your candidate – number at the top of each attached sheet.
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string.
5. For all sheets of paper on which rough/draft work has been done, cross it through and ATTACH to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. You are to answer ALL FIVE (5) questions in this examination. Each question carry equal marks.
8. Only Non-programmable calculators are permitted into the examination hall.
9. CANDIDATES ARE NOT ALLOWED TO EXCHANGE NOTES OR MATERIALS DURING THE COURSE OF THIS EXAMINATION.

QUESTION 1

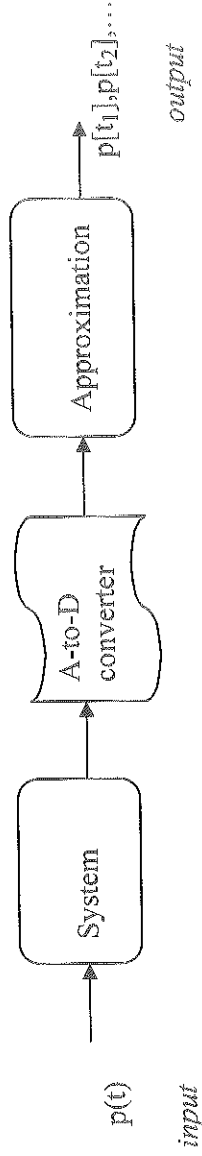
- (a) Measurement is crucial in industries and elsewhere. Use appropriate diagram to describe each component of a generalised measurement system and to show the role each plays for the whole measurement system. (8 marks)
- (b) Briefly analyse and describe the statistical characteristics of measurement system and explain how it can be applied as an effective tool for measurement analysis. (4 marks)
- (c) Assess and give a short account of the factors affecting the accuracy of measuring systems. (5 marks)
- (d) A simple dynamic system is one which satisfies a first order, linear, differential equation. Suppose the system is represented by the quotient of G_{dc} by $(S\tau + 1)$, produce a block diagram of this dynamic system in which $u(t)$ and $y(t)$ are the respective input and product of the system. If a first order dynamic system is presented by $\tau dx/dt + x(t) = G_{dc} \cdot u(t)$, identify the parameters that will determine its manner of response. (3 marks)

[Total: 20 Marks]

QUESTION 2

- (a) Present day measuring instruments are classified into categories according to their purposes. Mention each category and give an account of the economic value of each, (Use diagrams to demonstrate the category). (5 marks)
- (b) The application of instruments depends on the performance characteristics of each type. Name these types of instruments and state the difference. Give an example of each and use diagrams to show the difference. (5 marks)
- (c) Give a brief description of deterministic and non-random signals which are present in nearly all industrial systems and make a distinction between the two signals. (4 marks)

- (d) Write an analytical account of the series of steps involved in dynamic error and accurate measurements of random signals. Hereunder is a typical block diagram of a dynamic measurement system. How does it respond to the continuous-time values?



(6 marks)
[Total: 20 Marks]

QUESTION 3

- (a) Utilise an analytical account for the need of standards and briefly mention the types of measurement standards with suitable examples. (5 marks)
- (b) Analyse and use the criterion of choosing the signal processing elements such as converters, encoders and indicators in industrial or similar measurement. (6 marks)
- (c) Reliability of instruments and equipment is very important in industries. Give a brief description of reliability with regard to wear and tear, aging, mean time to failure, mean time to repair, mean to between failure and failure in time. (5 marks)
- (d) Comment on the suitability of the resistive sensing elements and electromagnetic sensing elements for industrial measurement. (4 marks)

[Total: 20 Marks]

QUESTION 4

- (a) Assess the suitability of null measurement in standardization. Design an experiment to demonstrate a null measurement. (6 marks)
- (b) Localisation of cable faults in telephone lines is always a frequent problem in the telecommunication industry. Describe what localization of cable fault is and design an experiment to test this in a laboratory situation using the Murray Loop test technique. Further, show how to find out the locality of the fault by using Whinstone bridge technique, (8 marks)
- (c) In control engineering signal conditioning is involved. Analyse the significance of this process. (3 marks)
- (d) A ramp-type analogue to digital conversion system uses 10 megahertz clock generator and ramp voltage that increases from 0 volt to 1.25 volts in a time of 125 milliseconds. Determine the number of clock pulses counted into the register when the voltage is 0.9 volt. (3 marks)

[Total: 20 Marks]

QUESTION 5

- (a) Analyse the different techniques involved in data acquisition system and state their advantages. Credits shall be awarded on its relevance to industrial application. (6 marks)
- (b) Big data is a new concept and scientists have not made a uniform definition of its data quality and quality criteria. An appropriate quality assessment method for big data is necessary to assist in drawing valid conclusions. Propose and draw a systematic flow diagram for quality assessment process for big data. (4 marks)
- (c) Use a block diagram to illustrate how a pneumatic sensor works and mention also its advantages and disadvantages, List the types available nowadays and mention the industrial usage. (5 marks)
- (d) In gas chromatography, the response is in the form of a graph of response against time or volume. Given that the height of the response curve is proportional to the mass flow rate of the tested sample as v_s is equal to dm/dt . Show that the area under the curve is also equal to the integral of the quotient of the solute volume, v_s , by the sum of volume of solute, v_s , and volume of carrier, v_c , by change in time, dt . (5 marks)
[20 marks]

The End