TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIVERSITY EXAMINATION (SUPPLEMENTARY) FOR:

DIPLOMA IN TECHNOLOGY IN INSTRUMENTATION AND CONTROL ENGINEERING

ETI 2231: TELEMETRY AND NETWORKING I.

END OF SEMESTER EXAMINATION

SERIES: AUGUST, 2019

TIME: 2 HOURS

DATE: AUGUST, 2019

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt any THREE out the FIVE questions.

Do not write on the question paper.

Question ONE

(a) With the aid of a block diagram, explain the functioning of a radio telemetry.

[10 marks]

(b) Distinguish between AC and DC telemetry and give an example of each case.

[5 marks]

(c) Explain thermocouple transducer. **[5 marks]**

Question TWO

(a) (i) Explain the need of a control room

(ii) State the requirements of control room. **[10 marks]**

(b) With the aid of a well labelled diagram describe the layout and components of typical industrial SCADA system. **[10 marks]**

Question THREE

(a) (i) State the Shannon and Hartley capacity theorem.

(ii) Determine the maximum bit rate that can be transmitted over a channel having a band-with of 4 kHz and signal-to-noise ratio of 48dB. **[4 marks]**

(b) (i) State the THREE stages of analogue to digital conversion

(ii) State the Nyquist sampling theorem and explain with suitable waveform and sketch its application in the reconstruction of a signal. **[10 marks]**

(c) A two-phase shift key modulation (2psk) has an input bit rate of 2400 b/s and work into a commercial speech band circuit. Determine:

(i) The number of possible symbols at the output
(ii) The symbol rate
(iii) The phase difference between the symbols
(iv) The maximum bit rate. **[6 marks]**

Question FOUR

(a) (i) State THREE criteria that define the important performance and compatibility requirements for optical detectors in telemetry.

(ii) When $3x10^{11}$ photons each with a wavelength of 0.85μm are incident on a photodiode on average $1.2x10^{11}$ electrons are collected at the terminals of the device. Determine the quantum efficiency and the responsivity of the photodiode at 0.85μm. **[6 marks]**

(b) Define the following terms:
(i) Transmission lines
(ii) Characteristics impedance
(iii) Voltage standing wave ratio (VSWR) **[6 marks]**

(c) State and describe the FOUR types of losses that occur in transmission lines. **[8 marks]**

Question FIVE

(a) In a piece of text only the following letters are used. The number of times each letter appears is given in brackets after the letter.

A(183), B(183), C(183), D(108), E(108), F(67), G(67), H(69), I(34).

Determine the following:

(i) The minimum number of bits per character.
(ii) The Huffmann codes
(iii) The compression rate.
(iv) The efficiency. **[10 marks]**

(b) Discuss losses in optical waveguides. **[4 marks]**

(c) When the mean optical power launched into an 8km length of fiber is 120μW, mean optical power at the fiber output is 3μW.

Determine :

(i) The overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices

(ii) The signal attenuation per kilometre for the fibre.

(iii). The overall signal attenuation for a 10 km optical link using the same fiber with splices at 1 km interval each giving an attenuation of 1dB .

(iv). The numerical input/output power ratio in (iii). **[6 marks]**