PP1

TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY

MEDICAL ENGINEERING DEPARTMENT

UNIVERSITY EXAMINATION FOR:

BSC MEDICAL ENGINEERING

EBL4502 BIOMEDICAL SIGNAL PROCESSING SYSTEMS

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2024

TIME: 2 HOURS

DATE:

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** Questions; Question ONE is compulsory. In addition attempt any Other TWO Questions.

Do not write on the question paper.

Question ONE (Compulsory)

(a) (i) State any **FIVE** sources of biomedical signals.

(ii) For the following biomedical signal parameters, give the signal characteristics and corresponding Electrode type:
ECG, EEG, EMG, Electro retirograph, Electro oculography **(15 marks)**

(b) Sketch a typical ECG signal and lable its components. **(10 marks)**

(c) Draw a block diagram of a Digital Bio medal signal processing system and describe the function of each block. **(5 marks)**

Question TWO

(a) Write C, Java or MATLAB code to implement IIR filtering in direct form (**9marks)**

(b) Write C , JAVA or MATLAB code to implement;

(i) Basic convolution

(ii) Block convolution by add overlap method **(11 marks)**

Question THREE

(a) Show that the decimation in time and in place Radix two fast Fourier transform may be used to compute the DFT of a sequence. **(10 marks)**

(b) Use Decimation in time and in place radix two fast fourier transform to compute the DFT of:

$x(n)=[0, 2, 3, 4, 3, 4, 2, 0]$

(10 marks)

Question FOUR

(a) Derive the general form of Discrete Fourier transform pair. **(10 marks)**

(b) Determine and plot the magnitude and phase response a unit discrete sequence:

$h(n)=1,\ 0 \leq n-1$

(10 marks)

Question FIVE

(a) Describe using appropriate equations the application of digital signal processing in the following operations:

(i) Noise reduction

(ii) 1st order IIR smoothing

(iii) Notch filter

(iv) Comb filter

(12 marks)

(b) With the aid of a diagram and equations show the necessary conditions for an LTI system to be:

(i) Stable

(ii) Causal **(8 marks)**