(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

SPECIAL /SUPPLEMENTARY EXAMINATIONS
YEAR FOUR SEMESTER ONE EXAMINATIONS

FOR THE DEGREE OF
BACHELOR OF SCIENCE COMPUTER SCIENCE

COURSE CODE: CSC 451E

COURSE TITLE: DIGITAL SIGNAL PROCESSING II

DATE: 02/02/2021   **TIME:** 08:00A.M – 10:00 A.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION **ONE** AND ANY OTHER **TWO** QUESTIONS

QUESTION ONE [COMPULSORY] [30 MARKS]

a) (i) Prewarping

    (ii) Bilinear transformation

    (iii) Gibbs Phenomenon

    (iv) Sampling Theorem

    (v) Filter

    (vi) Rectangular window   **[6 marks]**

b) State any four characteristics of an ideal filter   **[4 marks]**

c) Proof that an FIR system is always stable   **[6 marks]**

d) Outline any four functions of a filter in electronic circuits   **[4 marks]**

e) Mention any two techniques for digitizing the transfer function of an analog filter.   **[2 marks]**

f) Briefly explain any two limitations of impulse invariance mapping technique.   **[4 marks]**

g) Compare the rectangular window and hanning window   **[4 marks]**

QUESTION TWO [20 MARKS]

a) Briefly outline the practical applications of filters   [4 marks]

b) Using an appropriate mathematical relation or otherwise, briefly explain the meaning of the term 'Warping effect' as used in Bilinear Transformation   [4 marks]

c) Sketch the basic block diagram indicating the details of transformation of an analogue signal to a digital filter. Briefly give the details at each stage   [6 marks]

d) Write the procedure for FIR filter design by frequency sampling method.   [6 marks]

QUESTION THREE [20 MARKS]

a) Mention various methods available for the design of FIR filters   [3 marks]

b) Highlight the advantages and disadvantages of FIR filters   [7 marks]

c) (i) Draw the general realization structure in direct-form I of IIR system.   [4 marks]

   (ii) What is the main disadvantage of direct form-I realization?   [2 marks]

d) Compare IIR and FIR filters   [4 marks]

QUESTION FOUR [20 MARKS]

a) (i) What is bilinear transformation?   [1 mark]

   (ii) What are the features of a bilinear transformation?   [4 marks]

b) What are the different types of structures for realization of IIR systems?   [4 marks]

c) List any three desirable features of an analog to digital mapping for IIR filter design coefficient.   [3 marks]

d) Outline the differences between Impulse Invariance and Bilinear Transformation   [4 marks]

e) A second order FIR discrete time filter has the difference equation:

$$y[n] = x[n] - 0.95\, x[n-1] + 0.9\, x[n-2]$$

Find its poles and zeros, plot these on the z plane, and estimate its gain response.   [4 marks]

QUESTION FIVE [20 MARKS]

a) Give the square magnitude function of Butterworth filter and define each term   **[3 marks]**

b) What are the similarities and differences between Butterworth & Chebyshev filters.

    [5 marks]

    [4 marks]

c) Write the procedure for designing FIR filter using window

d) Design a second order Butterworth-type IIR lowpass filter with $\Omega_c = \pi / 4$.   **[8 marks]**