MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2015/2016

SECOND YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER TECHNOLOGY

MAIN CAMPUS

CCT 214: SIGNALS AND SYSTEMS

Date: 26th April, 2016 Time: 11.00 - 1.00 pm

INSTRUCTIONS:

- Answer question ONE and any other TWO questions.
- Write your registration number on all sheets of the answer book used.
- Use a NEW PAGE FOR EVERY QUESTION attempted, and indicate number on the space provided on the page of the answer sheet.
- Fasten together all loose answer sheets used.

Question One(30mks)

a) List any FOUR ways of classifying a signal (4mks)

b) Define the following as applied to systems and give one example of each:

i) memoryless (2mks)
ii) causal (2mks)
iii) time-invariant (2mks)
iv) stable (2mks)
v) Linear (2mks)

c) Determine if the following signals are periodic. If yes, determine the fundamental period.

(i) $g_1(t) = 3\sin(4\_t) + 7\cos(3\_t)$; (5mks)

(ii) $g_2(t) = 3\sin(4\_t) + 7\cos(10t)$. (5mks)

d) Sketch the following signals:

i) $u(t) = 1;\ t \geq 0$
OI $t < 0$. (2mks)

ii) $r(t) = tu(t) = t;\ t \geq 0$
$0;\ t < 0$, (2mks)

iii) $x(t) = \sin(\_\omega + \Theta)$ (2mks)

Question Two(20mks)

Consider an LTI system with impulse response h[n] and input x[n] given as follows:

h[n] = 1; 0 <= n <= 2
0; otherwise

x[n] = 0.5; n = 0
2; n = 1
0; otherwise

a) Sketch both h[n] and x[n] (6mks)

b) Compute the output of the system(the convolution sum)

$y[n] = h[n]*x[n]$

and sketch y[n]

Question Three(20)

a) Write the equation for computing the Dicrete Fourier Transform(DFT) of a sequence (4mks)

b) i) Calculate the four-point DFT of the aperiodic sequence $x[k]$ of length $N = 4$, which is defined as follows:

$$x[k] = \begin{cases} 2\,; & k = 0 \\ 3\,; & k = 1 \\ -1\,; & k = 2 \\ 1\,; & k = 3. \end{cases}$$ (12mks)

ii) Sketch both x[k] and its DFT (4mks)

Question Four(20mks)

a) Write the equation for computing the Z-transform of a sequence and explain what is meant by region of convergence (6mks)

b) Let x[n] be causal signal given by

$$x[n] = a^n u[n]$$

Compute its Z-tnsform and sketch the ROC (14 mks)

Question Five(20mks)

a) Calculate:

i) instantaneous power (5mks)

ii) average power (5mks)

$y[n] = h[n]*x[n]$

and sketch y[n]

Question Three(20)

a) Write the equation for computing the Dicrete Fourier Transform(DFT) of a sequence (4mks)

b) i) Calculate the four-point DFT of the aperiodic sequence $x[k]$ of length $N = 4$, which is defined as follows:

$$x[k] = \begin{cases} 2 ; k = 0 \\ 3 ; k = 1 \\ -1; k = 2 \\ 1; k = 3. \end{cases}$$ (12mks)

ii) Sketch both x[k] and its DFT (4mks)

Question Four(20mks)

a) Write the equation for computing the Z-transform of a sequence and explain what is meant by region of convergence (6mks)

b) Let x[n] be causal signal given by

$$x[n] = a^n u[n]$$

Compute its Z-tnsform and sketch the ROC (14 mks)

Question Five(20mks)

a) Calculate:

i) instantaneous power (5mks)

ii) average power (5mks)

iii) energy (5mks)

of the following signals and hence classify them as either energy or power signals.

$x_1(t) = 5 ; -2 \leq t \leq 2$
0 ;otherwise.

$x_2[k] = e^{-0.5k} ; k \geq 0$
$0; \ k < 0.$

b) Sketch both signals in (a) above. (5mks)