Index Number: UE20027715 Programme: BSC COMPUTER ENGINEERIN

UNIVERSITY OF ENERGY AND NATURAL RESOURCES, SUNYANI, GHANA

SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER AND ELECTRICAL ENGINEERING, UENR

LEVEL 300: END OF SECOND SEMESTER EXAMINATION, 2016/2017

Bachelor of Science (Electrical and Electronics and Computer Engineering)

ELNG 222: Signals and Systems

May, 2017 **Time: 2 Hours**

Materials required: Non-programmable calculator

Instructions: Answer all questions.

Question 1 [20 marks]

a. A continuous-time signal $x(t)$ is shown in figure 1. Sketch and label each of the following signals.

i. $x(t-2)$ ii. $x(2t)$ iii. $x(t/2)$ iv. $x(-t)$

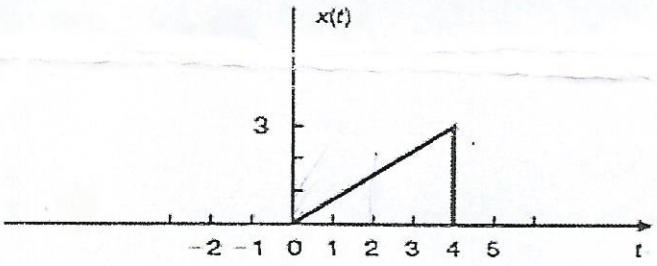

Figure 1

[6 marks]

b. A discrete-time signal $x[n]$ is shown in figure 2. Sketch and label each of the following signals.

i. $x[n-2]$ ii. $x[2n]$ iii. $x[-n]$ iv. $x[-n+2]$

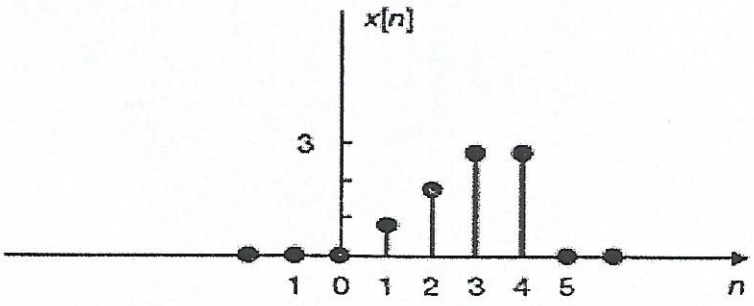

Figure 2

[6 marks]

Index Number: _____ **Programme:** _____

c. State the time shifting property and the frequency shifting property of Fourier Series. **[3 marks]**

d. Compute the energy $E_{\infty}|$ and the power $P_{\infty}|$ of the following discrete-time signal $x[n] = j$ **[5 marks]**

Question 2 [15 marks]

a. Find the range of convolution of the signals given below, and then find the DC component of the resultant convoluted signal.

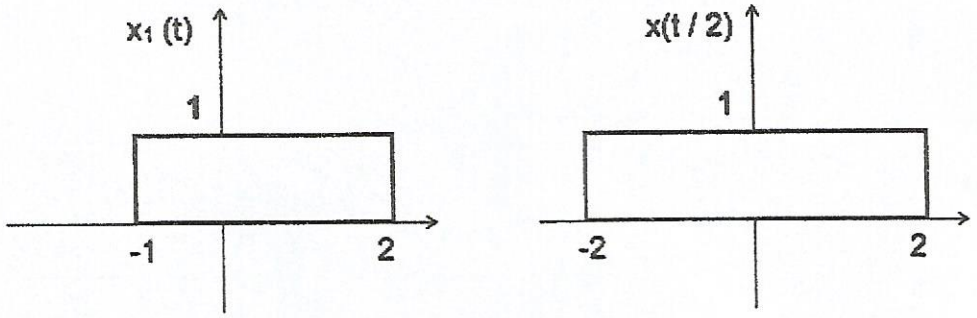

Figure 3 **[5 marks]**

b. Convolute two sequences x[n] = {1,2,3} and h[n] = {-1,2,2} **[6 marks]**

c. State the convolution property in relation to Fourier transforms. **[2 marks]**

d. What is the relationship between Fourier Series and Fourier Transform? **[2 marks]**

Question 3 [15 marks]

a. What is the use of Laplace transform? **[2 marks]**

b. What are the types of Laplace transform? **[2 marks]**

c. Find the Laplace transform of **[8 marks]**

(i) $x(t) = -e^{-at}u(-t)$

(ii) $x(t) = e^{at}u(-t)$

d. State the properties of convolution? **[3 marks]**

Index Number: UE2002T/15 Programme: _____

Question 4 [10 marks]

a. We wish to design a linear, time-invariant, continuous-time system that is causal and stable. For asymptotically low frequencies, the magnitude of the system's frequency response should be 4ω. For asymptotically high frequencies, the magnitude of the system's frequency response should be 100/ω.

Is it possible to design such a system so that the magnitude of its frequency response is 50 at ω = 5? If **Yes**, determine the poles of the resulting system, and if **No**, briefly explain why not.

$$E_\infty = \lim_{N\to\infty} \sum_{n=-N}^{N} |j|^2$$

$$= \lim_{N\to\infty} \sum_{n=-N}^{N} \left(\sqrt{jj^*}\right)^2$$

$$= \lim_{N\to\infty} \sum_{n=-N}^{N} \left(\sqrt{j\bar{j}}\right)^2$$

$$= \lim_{N\to\infty} \sum_{n=-N}^{N} 1 = \infty$$

$$= \lim_{N\to\infty} C$$

So $E_\infty = \infty$