

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2014/2015 ACADEMIC YEAR

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN
TELECOMMUNICATION**

TLCM 417: SIGNALS AND SYSTEMS

DAY: MONDAY

DATE: 13/4/ 2015

TIME: 14:00PM- 16:00PM

STREAM: Y4S1

INSTRUCTION TO CANDIDATE

- **ATTEMPT QUESTION ONE AND ANY OTHER THREE**

QUESTION ONE (30 MARKS)

- a) A discrete time signal is represented by the following sequence $x(n) = \{0,0,0,1,2,3,3\}$, sketch and label each of the following signals. ↑
- i. $x(n-3)$ 2marks
 - ii. $x(3n)$ 2marks
 - iii. $x(-n+3)$ 2marks
- b) Give any FOUR reasons why signal processing in digital domain is better than the analog domain (4marks)
- c) Given $y(n) = \frac{x^2(n)}{x(n-1)}$ prove that the system is homogeneous (4marks)
- d) The input $x(n]$ and the impulse response $h(n)$ of a discrete –time LTI system are given by $x(n)=u(n)$ and $h(n)=a^n u(n)$ for $0 < a < 1$. determine $y(n)=x(n) * h(n)$ (6marks)
- e) Find the frequency response of the system describe by the following LCCDE $y(n)=1.349y(n-1) -0.9y(n-2)+x(n)-1.41x(n-1) + x(n-2)$ (4marks)
- f) Given the sequence $x(n)=(6-n)[u(n)-u(n-6)]$, determine $y(n)=x(4-n)$ (4marks)
- g) Define the convolution theorem in frequency domain of two sequences $x(n)$ and $h(n)$ (2marks)

QUESTION TWO (20 MARKS)

- a) Determine the fundamental period of the following signal $x(n] = e^{j\frac{\pi n}{16}} \cos(n\pi/17)$ (4marks)
- b) A system is represented by the following sequence $x(n] = -a^n u(-n-1)$ and $|a| > 1$ determine the DTFT
6marks
- c) Briefly state the following properties of Discrete Time Fourier Transform
- Linearity
 - Time reversal
 - Modulation
 - Convolution
- 4marks
- d) Consider the following LCCDE for $y(n] - 0.25y(n-1) = x(n] - x(n-2)$ for $x(n] = \delta(n)$ solve for $y(n)$ using the DTFT method.
(6marks)

QUESTION THREE (20 MARKS)

- a) Solve the following LCCDE for $y(n)$ assuming zero initial conditions
 $y(n] - 0.25y(n-1) = x(n] - x(n-2)$ using DTFT. When $x(n] = \delta(n)$ (6marks)
- b) If $h(n)$ is the system response to an LSI system. Find the frequency response when
 $h(n] = \delta(n] + 6\delta(n-1] + 3\delta(n-2)$
(7marks)
- c) Give elaborate account of the process of digital to analog conversion indicating relevant expressions
(7marks)

QUESTION FOUR (20 MARKS)

- a) Find the z-transform of the sequence $x(n] = \left(\frac{1}{3}\right)^n u(-n)$ (4 marks)
- b) Find the z-transform of $x(n] = \left(\frac{1}{2}\right)^n u(n] - 2^n u(n-1)$. Show the ROC (6marks)
- c) Find the inverse of the following z-transform $X(z) = \frac{1}{1 + 3z^{-1} + 2z^{-2}}$ $|z| > 2$ (4marks)
- d) Prove the following DTFT theorems
- Periodicity
 - Shifting
 - Conjugate
- 6marks

QUESTION FIVE (20 MARKS)

- a) Given the following sequence use graphical method to perform the convolution $y(n)=x(n)*h(n)$.
 $x(n)=\{ 1 2 3 4 5 \}$ and $h(n)=\{6 3 5 7 8\}$ 8marks
- b) Find the z-transform of the following sequences
 $y(n)=x(n)+x(n-1)+x(n-2)$ 4marks
- c) Name any four signal sources applicable for digital signal processing 4marks)
- d) Define the following properties of LSI systems
- i. Additivity 2marks
 - ii. Homogeneity 2marks