VIETNAM NATIONAL UNIVERSITY, HANOI
University of Engineering and Technology

Date: June 14, 2015

FINAL EXAMINATION
Course: **Signals and Systems (ELT2035)**
Duration: 90 minutes

Part 1 (Multiple-choice questions)*: For problems in this part, you only have to give the letter of the correct answer (A/B/C/D). Explanations are not required.*

Problem 1. Which one of the LTI systems represented by the following impulse responses is stable?

A. $h(t)=\sin(3\pi t)u(t)$

B. $h(n)=\cos(\pi n/3)[u(n+5)-u(n-5)]$

C. $h(n)=u(-n)$

D. $h(t)=(e^{2t}-e^{-2t})u(t)$

Problem 2. What is the Nyquist rate of the signal

$$x(t)=\cos(800\pi t+\pi/2)+2\sin(1600\pi t+\pi/4)+3$$

A. 400 Hz

B. 800 Hz

C. 1600 Hz

D. 3200 Hz

Problem 3. Given a discrete-time LTI system described by the difference equation $4y(n)+y(n-2)=x(n-1)$, which one of the following statements about this system is correct?

A. The system is stable if it is causal.

B. The system is stable if it is anti-causal .

C. The system is stable if it is non-causal.

D. The system is unstable.

Problem 4. A discrete-time signal $x(n)$ has the Fourier transform given by $X(\Omega)=\dfrac{4e^{i\Omega}-5}{2e^{j2\Omega}-5e^{j\Omega}+2}$. What is $x(n)$?

A. $2^{-n}u(n)+2^{n}u(n)$

B. $-2^{-n}u(-n-1)-2^{n}u(-n-1)$

C. $2^{-n}u(n)-2^{n}u(-n-1)$

D. $-2^{-n}u(-n-1)+2^{n}u(n)$

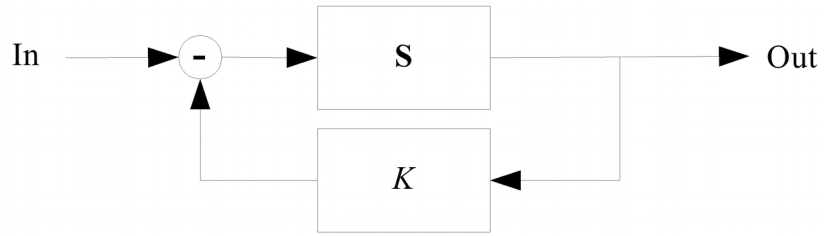
Part 2 (Exercises)*:For problems in this part, detailed explanations/derivations that lead to the answers must be provided.*

Problem 5. Given a causal LTI system described by the following difference equation:

$$2\,y(n)+3\,y(n-1)+y(n-2)=2\,x(n-1)$$

a) Determine the impulse response of the given system.
b) Determine the zero-state response $y_s(n)$ of the given system to the step input $x(n)=u(n)$.

Problem 6. Given a causal system **T** described by the following block diagram:



in which, **S** is a continuous-time LTI system described by the differential equation $y(t)-\frac{dy(t)}{dt}=x(t)+\frac{dx(t)}{dt}$ and K is a constant.

a) Determine the condition for K so that system **T** is stable.
b) Determine the frequency response and the magnitude response of system **T** when $K = 2$.
c) Determine the output signal $y(t)$ of system **T** when $K = 2$ and the input signal $x(t)=\cos(3\pi t+\pi/4)+2\sin(\pi t/2)+1$.
d) Compute the power of the output signal $y(t)$ obtained in c).

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