Seat Number

King Mongkut's University of Technology Thonburi
Midterm Examination
Semester 1 -- Academic Year 2016

Subject: EIE 460 Digital Signal Processing
For: Electrical Communication and Electronic Engineering, 4th Yr (Inter. Program)
Exam Date: Thursday, September 22, 2016 **Time:** 13.00-16.00

Instructions:-

1. This exam consists of 4 problems with a total of 6 pages, including the cover.
2. This exam is opened book.
3. Answer each problem on the exam itself.
4. A calculator compiling with the university rule is allowed.
5. A dictionary is **not** allowed.
6. **Do not** bring any exam papers outside the exam room.

Remarks:-

- **Raise your hand when you finish the exam to ask for a permission to leave the exam room.**
- **Students who fail to follow the exam instruction might eventually result in a failure of the class or may receive the highest punishment with university rules.**

Exam No.	1	2	3	4	Total
Full Score	30	20	35	45	130
Graded Score					

Name-Lastname _____ **Student ID** _____

This examination is designed by
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This examination has been approved by the committees of the ENE department.

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1. Let the signal $x[n]=e^{0.001n}\left(u[n]-u[n-20]\right)$ be the input to the following difference equation described by (30 marks)

$$y[n]-3.5y[n-1]-1.5y[n-2]=3x[n]+4x[n-1]$$

   a. Write Matlab script to generate and plot the signal $x[n]$.
   b. Write Matlab script to determine the response $y[n]$ over $0\le n\le 200$.
   c. Find the frequency response $H(e^{j\omega})$.
   d. Find the Fourier transform $X(e^{j\omega})$.
   e. Write Matlab script to find the Fourier transform $X(e^{j\omega})$ and use 501 equispaced points for $0\le\omega\le\pi$.

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2. Determine whether the system $y[n] = 10\sin(0.1\pi n)x[n]$. (20 marks)
   a. linear
   b. time-invariant
   c. causal
   d. stable

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3. An impulse response is $h[n]=(-0.9)^n u[n]$. (35 marks)
   a. Plot $h[2-n]$.
   b. If an input signal is $x[n]=0.8^n$ for $0 \le n \le 9$, find the output signal $y[n]$.
   c. Find the frequency response $H(e^{j\omega})$.
   d. If an input signal is $x[n]=\cos(0.1\pi n)$, find the output signal $y[n]$.
   e. Find the impulse response of $e^{-j5\omega}H(e^{j\omega})$.
   f. Can we use Matlab to find the output signal $y[n]$? Give a reason.

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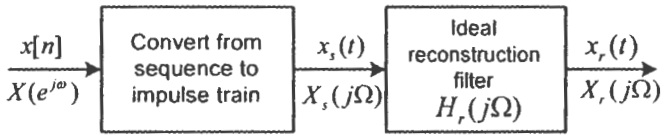
4. Sampling an analog signal given as $x_a(t) = 4 + 2\cos(500\pi t)$ for $0 \le t \le 1$ sec. with the sampling frequency 1000 samples/sec. (45 marks)
   a. Find the discrete-time sequence $x[n]$.
   b. Find the Fourier transform $X(e^{j\omega})$.
   c. Sketch $X_a(j\Omega)$ and $X(e^{j\omega})$ for $-2\pi \le \omega \le 2\pi$ where $X_a(j\Omega)$ is the spectrum of $x_a(t)$ and $X(e^{j\omega})$ is the spectrum of $x[n]$.
   d. Write Matlab script to find $X_a(j\Omega)$ and $X(e^{j\omega})$ at 501 equispaced points for $0 \le \Omega \le 2000\pi$ and $0 \le \omega \le \pi$.
   e. Use $X(e^{j\omega})$ from c. to sketch $X_s(j\Omega)$, $H_r(j\Omega)$ and $X_r(j\Omega)$.



   f. Write Matlab script to rcconstruct the analog signal $x_a(t)$ from the sequence $x[n]$.

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For problem 4 continued