Analog and Digital Signal Processing
Course Code: CSE363
Mid-Term Exam.

BME Program
Level 300
Exam Date: 9-11- 2019
Allowed Time: 1 Hour

Open-Sheet Exam.
30 Marks

Answer three only of the following questions.

Q.1) For a *BIBO stable* system described by the transfer function $H(s) = \frac{s}{s^2 - s - 6}$

i. Locate poles and zeros on the s-plane.
ii. Determine the associated impulse response. **[5 Marks]**

Q.2) Consider an LTI system described by the differential equation

$$y'(t) + 3y(t) = x(t) \quad , \quad y(0) = 2 \quad , \quad x(t) = e^{-t}u(t)$$

i. Determine the output of the system.
ii. Express the output *y(t)* as a sum of two components; the zero-state response and the zero-input response. **[5 Marks]**

Q.3) Find the inverse Z-transform the following function using power series expansion.

$$X(z) = \frac{z+4}{z^2 - 3z + 2} \qquad |z| < 1$$ **[5 Marks]**

Q.4) Design a maximally flat analog low-pass filter with the following specifications:
i. A pass-band of (0≤Ω≤30 rad/sec).
ii. A stop-band attenuation of greater than 20 dB for Ω≥100 rad/sec. **[5 Marks]**

Answer the following questions:

Q.5) Consider the following continuous signal $x(t) = e^{j(10t+\pi)}$. Find the value of the sampling interval T_s such that $x[n] = x(nT_s)$ is a periodic sequence. Find the fundamental period of $x(nT_s)$ if $T_s = 0.2\pi$ seconds. **[5 points]**

Q.6) Evaluate each of the following: **[5 points]**

i. $\sum_{n=-\infty}^{\infty} 4\,[u(n/2) - u(n-3)]$

ii. $\int_{-\infty}^{\infty} e^{-5t}\,\delta''(2t-3)\,dt$

Q.7) Determine whether or not each of the following signals is periodic. If a signal is periodic, determine its fundamental period. **[5 points]**

i. $x(t) = e^{10\pi t} + \cos 5\pi t + \sin \frac{\pi}{3} t$

ii. $x(n) = \sum_{k=1}^{3} \sin(\frac{k\pi n}{8} + k\pi/6)$

Best wishes to all of you!

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