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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST – 3 EXAMINATION- JUNE-2016

B.Tech. IV SEMESTER (CSE, IT)

COURSE CODE:10B11EC301 MAX. MARKS: 35

COURSE NAME: SIGNALS AND SYSTEMS

COURSE CREDITS: 04 MAX. TIME: 2 HRS

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

Q1. (a) Write the condition, in terms of impulse response $h(t)$, for the (i) causal system, and (ii) stable system. [2]

(b) Consider the continuous-time signal $x(t) = \delta(t+2) - \delta(t-2)$. Calculate the value of E_∞ for the signal $y(t) = \int_{-\infty}^{t} x(\tau)d\tau$. [3]

Q2. (a) Explain the Gibbs phenomenon for the continuous-time Fourier series (CTFS). [2]

(b) A causal and stable LTI system has the frequency response $H(j\omega) = \frac{j\omega+4}{6-\omega^2+5j\omega}$.

(i) Determine the impulse response $h(t)$ of the system.

(ii) What is the output of the system for the input $x(t) = e^{-4t}u(t) - te^{-4t}u(t)$?

[1.5+1.5=3]

Q3 Consider a continuous-time LTI system for which the input $x(t)$ and output $y(t)$ are related by the differential equation $\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$.

(a) Determine $H(s)$ and sketch its pole-zero pattern. [2+1=3]

(b) Determine $h(t)$ for each of the following cases: (i) The system is stable, (ii) the system is causal, (iii) the system is neither stable nor causal. [3]

Q4. (a) Let $g(t) = x(t) + \alpha x(-t)$, where $x(t) = \beta e^{-t}u(t)$ and Laplace transform of g(t) is $G(s) = \frac{s}{s^2-1}$, $-1 < Re\{s\} < 1$. Determine the values of the constants α and β. [4]

(b) Let $x(t)$ be a signal that has a rational Laplace transform with exactly two poles, located at $s = -1$ and $s = -3$. If $g(t) = e^{2t}x(t)$ and $G(j\omega)$ converges, determine whether $x(t)$ is left sided, right sided or two sided. [3]

Q5. (a)Sate the properties of the region of convergence (ROC) of z- transform. [4]

(b) Determine the unilateral z-transform of the signal $x[n] = a^{n+1}u[n+1]$. [2]

Q6. (a) State and prove the sampling theorem mathematically. [3]

(b) Using partial-fraction expansion find the inverse z-transform of

$$X(z) = \frac{1-\frac{1}{3}z^{-1}}{(1-z^{-1})(1+2z^{-1})}, |z| > 2.$$ [3]