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Roll No:.....

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST - 3 EXAMINATION- DECEMBER 2017

B.Tech III Semester

COURSE CODE: 10B11EC301 MAX. MARKS: 35

COURSE NAME: Signals and Systems COURSE CREDITS: 04

MAX. TIME: 2 Hrs

Note: *All questions are compulsory. Assume the data wherever necessary.*

Q1. (a) A discrete time system is described by the following input-output relationship

$$y[n] = \sum_{k=n-2}^{n+2} x[k]$$

Check whether the system is linear and time-invariant. [4]

(b) Determine the causality and stability of the LTI system defined by the impulse response

$h(t) = e^{2t}u(-1-t)$ [3]

Q2. Consider a causal LTI system implemented as the series RLC circuit where $x(t)$ is the input voltage and $y(t)$ is the voltage across the capacitor considered as the system output. The resistance R = 1Ω, inductor L = 1H and capacitor C = 1F. Draw the circuit and determine the system function $H(s)$ with the corresponding impulse response. Also specify the region of convergence. [7]

Q3. (a) State and explain the initial value theorem and final value theorem in s – domain. [3]

(b) Consider a signal $y(t)$ which is related to two signals $x_1(t)$ and $x_2(t)$ by

$$y(t) = x_1(t-2) * x_2(-t+3)$$

where $x_1(t) = e^{-2t}u(t)$ and $x_2(t) = e^{-3t}u(t)$. Use the properties of Laplace transform to determine the Laplace transform and the corresponding ROC of $y(t)$. [4]

Q4. (a) Consider a causal LTI system which is defined by the following difference equation:

$$y[n] - \frac{1}{3}y[n-1] + \frac{1}{8}y[n-2] = x[n] - 2x[n-1] + 6x[n-2]$$

Determine the system function and the block diagram representation of the system. [4]

(b) Determine the Z – transform, the corresponding ROC and the pole – zero diagram of the signal $x[n] = 2^n u[-n] + \left(\frac{1}{4}\right)^n u[n-1]$ [3]

Q5. Draw and explain the conformal mapping between s – plane and z – plane. [7]