JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- Oct 2017

B.Tech III Semester

COURSE CODE: 10B11EC301   MAX. MARKS:25

COURSE NAME: Signals and Systems

COURSE CREDITS: 4   MAX. TIME: One Hour Thirty Minutes

Note: All questions carry equal marks. Assume the data wherever necessary. Carrying of mobile phone during examinations will be treated as case of unfair means.

Q1. Determine the response of a continuous time LTI system described by the following differential equation:

$$\left(\frac{d^2}{dt^2}y(t) + 7\frac{d}{dt}y(t) + 12y(t)\right) = \left(\frac{d}{dt}x(t) + 2x(t)\right)$$

when the input to the system is $e^{-2t}u(t)$. The initial conditions are given as: $y(0^-) = 0$ and $y'(0^-) = 1$.

Q2. Determine the Fourier series representation of a sawtooth wave of amplitude 5 V and time period 1 second. Also sketch the magnitude and phase spectrum.

Q3. Given that $X(jw)$ is the CTFT of a signal $x(t)$. Express the CTFT of the following signal in terms of $X(jw)$:

$$y(t) = \frac{d^2}{dt^2}x(1-t)$$

Q4. Consider a causal LTI system with frequency response

$$H(jw) = \frac{1}{jw+3}.$$

For a particular input $x(t)$ this system is observed to produce the output

$$y(t) = e^{-3t}u(t) - e^{-4t}u(t)$$

Determine $x(t)$.

Q5. Compute the DTFT of the following signal. Also plot the frequency spectrum.

$$x[n] = 2^n \sin\left(\frac{\pi n}{4}\right)u[-n].$$