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BIEL-007

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

December, 2018

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BIEL-007 : SIGNALS AND SYSTEMS

Time : 3 hours *Maximum Marks : 70*

Note : *All questions carry equal marks. Use of scientific calculator is allowed. Attempt any* ***five*** *questions.*

1. (a) Check whether the following system is Time Invariant/Time Variant and also Causal/Non causal : 3

$$y(t) = x\left(\frac{t}{3}\right)$$

(b) Find out whether the following signals are energy or power signals or neither power nor energy. Determine power or energy as the case may be for the signal 7

$$x(t) = u(t) + 5u(t-1) - 2u(t-2).$$

(c) Determine if the signal x(n) given below is periodic. If yes, give its fundamental period. If not, state why it is aperiodic. 4

$$x(n) = \sin\left(\frac{6\pi}{7}\, n + 1\right)$$

2. (a) Perform convolution to find the response of the system 7

$x(n) = \{1, -1, 2, 3\}$, $h(n) = \{1, -2, 3, -1\}$.

(b) For a Causal LTI system the input x(n) and output y(n) are related through a difference equation

$$y(n) - \frac{1}{6}y(n-1) - \frac{1}{6}y(n-2) = x(n).$$

Determine the frequency response $H(e^{j\omega})$ and the impulse response h(n) of the system. 7

3. (a) Find the Fourier transform of a rectangular pulse with width T and amplitude A. 7

(b) Determine the unit step response of the LTI system defined by 7

$$\frac{\partial^2 y}{\partial t^2} + 5\frac{\partial y}{\partial t} + 6y(t) = \frac{\partial x}{\partial t} + x(t)$$

4. (a) Determine the continuous time Fourier transform of the signal

$$x(t) = t\, e^{at}\, u(t)$$

where u(t) is the unit step function. 7

(b) If $x(t) \leftrightarrow X(\omega)$, then using time shifting property show that 7

$x(t + T) + x(t - T) \leftrightarrow 2X(\omega) \cos \omega T$

5. (a) A causal system has

$$x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$$

and $y(n) = \delta(n) - \frac{3}{4}\delta(n-1)$.

Find the impulse response and output if

$$x(n) = \left(\frac{1}{2}\right)^n u(n).$$ 7

(b) List the different properties of Fourier transform. Prove any two of the properties. 7

6. (a) Determine the Fourier series expansion for a periodic ramp signal with unit amplitude and a period T. 7

(b) Find the DTFT of 7

$$x(n) = \left(\frac{1}{2}\right)^{n-1} u(n-1)$$

7. (a) Using suitable Z-transform properties, find X(Z) if 7

$$x(n) = (n-2)\left(\frac{1}{3}\right)^{n-2} u(n-2)$$

(b) Find inverse Z-transform of X(Z) using power series expansion technique : 7

$$X(Z) = \frac{Z}{2Z^2 - 3Z + 1} \quad |Z| > 1$$