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BIEL-007

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

Term-End Examination

00535

June, 2019

BIEL-007 : SIGNALS AND SYSTEMS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Examine whether the given signal is periodic or not. If periodic, then find out the period. *3*

$$x(t) = \sin(10t + 1) - 2\cos(5t - 2)$$

(b) Determine the even and odd part of the signal

$$x(t) = \cos(\omega t + \frac{\pi}{3}).$$ *4*

(c) State and prove the differentiation property of Fourier transform. *7*

2. (a) Find the continuous time Fourier transform of the Gate/Rectangular signal. Also plot its magnitude response. *10*

(b) Check whether the system is linear or non-linear : *4*

$$\frac{2d^2y(t)}{dt^2} + \frac{4dy(t)}{dt} + 3y(t) = x(t+1)$$

3. (a) Using Fourier transform, find the convolution of $x_1(t) = e^{-2t}\, u(t)$

$$x_2(t) = e^{-3t}\, u(t).$$ *7*

(b) Calculate the DTFT of the following using properties of DTFT : *7*

$$x(n) = u(n+3) - u(n-3)$$

4. (a) Determine the total response of differential equation

$$\frac{d^2y(t)}{dt^2} + \frac{3dy(t)}{dt} + 2y(t) = x(t),$$

where $y(0) = 3$, $y'(0) = 4$, $x(t) = 4e^{-2t}$ and $t \geq 0$. *7*

(b) Calculate the convolution for the given sequences : *7*

$$x(n) = \begin{cases} 1 & \text{for } n = -2, 0, 1 \\ 2 & \text{for } n = -1 \\ 0 & \text{else} \end{cases}$$

$$h(n) = \delta(n) - \delta(n-1) + \delta(n-2) - \delta(n-3).$$

5. (a) Find the impulse response and frequency response of the following discrete time system : *10*

$$y(n) - y(n-1) + \frac{3}{16} y(n-2) = x(n) - \frac{1}{2} x(n-1)$$

(b) Determine the minimum sampling frequency to be used to sample the signal $x(t) = 100 \operatorname{sinc}^2 100t$, if the signal $x(t)$ is to be recovered from the samples without any distortions. *4*

6. (a) Determine the inverse z-transform using partial fraction method for

$$X(z) = \frac{\left(\frac{1}{4}\right) z^{-1}}{\left(1 - \frac{1}{2} z^{-1}\right)\left(1 - \frac{1}{4} z^{-1}\right)}$$

for ROCs

(i) $|z| > \frac{1}{2}$

(ii) $|z| < \frac{1}{4}$

(iii) $\frac{1}{4} < |z| < \frac{1}{2}$ *10*

(b) Check whether the system is static/dynamic and causal/non-causal and why. *4*

$$y(n) = \log_{10} |x(n)|$$

7. (a) Using properties of z-transform, find z-transform and ROC of signal $x(n) = n \cdot 2^n \cdot \sin\left(\frac{n\pi}{2}\right) u(n)$. 7

(b) State and prove the following properties of z-transform : 7

(i) Convolution property

(ii) Frequency shifting