No. of Printed Pages : 4

BIEL-007

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

Term-End Examination

June, 2017

00024

BIEL-007 : SIGNALS AND SYSTEMS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Symbols used have their usual meanings.*

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1. (a) Distinguish between periodic, non-periodic and almost periodic signals. Give an example of each. *5*

(b) Examine whether the given signals are periodic or not. If periodic, find out the fundamental time period.

(i) $x(t) = \sin \frac{2\pi}{5} t \cos \frac{4\pi}{3} t$

(ii) $x[n] = u[n] + u[-n]$ *3+2=5*

2. (a) For the signal x(t) shown in Figure 1 given below, sketch the following : *3×2=6*

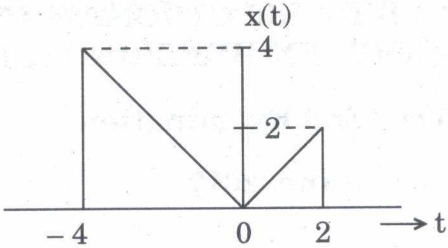

Figure 1

(i) $x(2 - t)$

(ii) $x\left(\dfrac{t}{1\cdot5}\right)$

(iii) $x(2t + 4)$

(b) Evaluate the following integrals : *2+2=4*

(i) $$\int_0^3 \exp(t - 2)\,\delta(2t - 4)\,dt$$

(ii) $$\int_0^8 t^2\,\delta(t - 9)\,dt$$

3. (a) What is a linear system ? Give an example of a linear system.

A system is described by the equation

$$\frac{dy(t)}{dt} + 2y(t) = x(t) + 5.$$

Examine whether the system is linear or not. *7*

(b) Check whether the system described by the equation $y[n] = x[-n]$ is causal or not. *3*

4. Represent a signal by a continuum of impulse and hence show that $y(t) = h(t) \otimes x(t)$, where $y(t)$ is the response of linear time-invariant system with impulse response $h(t)$ to the input $x(t)$. *10*

5. Determine the effect of each of the following symmetry conditions on the coefficient of the Fourier series expansion for $f(\theta)$ and obtain the formula for those coefficients which do not vanish : *10*

(a) $f(\theta) = f(\pi - \theta)$

(b) $f(\theta) = -f(\pi - \theta)$

6. (a) State the conditions to be satisfied by the signal so that its Fourier transform exists. *3*

(b) State the duality property of continuous time Fourier transform. *2*

(c) $A\text{rect}\left(\frac{t}{T}\right)$ and $AT\text{sinc}(fT)$ are a Fourier transform pair. Using duality property, find the Fourier transform of $A\text{sinc}(2Wt)$. Also sketch the magnitude spectrum. *5*

7. (a) If $x[n] \Leftrightarrow X(e^{j\omega})$,

show that $nx[n] \Leftrightarrow j\dfrac{dX(e^{j\omega})}{d\omega}$. *5*

(b) Using the above relation determine the Fourier transform of the signal

$$y[n] = (n-1)^2 \, x[n].$$ *5*

8. (a) State the initial value theorem for Z-transform and derive its mathematical formulation. Hence find the initial value of the signal corresponding to the following Z-transformation : *7*

$$X(z) = \frac{2 + z^{-1}}{(1 - z^{-1})(1 + 0{\cdot}5z^{-1})}$$

(b) Sketch the poles and zeros of the following transfer function : *3*

$$H(z) = \frac{z^2 + 1}{z^2 - 0{\cdot}25}$$

9. (a) Find the inverse Z-transform of

$$X(z) = \frac{(z - 1)(z + 0{\cdot}8)}{(z - 0{\cdot}5)(z + 0{\cdot}2)}$$ *5*

(b) Consider the system described by the difference equation $c[n + 1] + 2c[n] = \delta[n]$; $c[0] = 0$. Obtain the system impulse response $c[n]$. *5*

10. Write short notes on the following : *2×5=10*

(a) Mathematical representation of step, ramp, impulse functions and their inter-relationships

(b) Region of convergence and its properties