

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

Term-End Examination

00093

June, 2018

BIEL-007 : SIGNALS AND SYSTEMS

Time : 3 hours

Maximum Marks : 70

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

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1. (a) Determine whether $x(t) = 2 \sin (\sqrt{5} \pi t)$ is periodic or non periodic. Determine its fundamental time period. 3
- (b) Determine the Z-transform with possible Region of Convergence (ROC) of 7
- $$x(n) = 2^n u(n + 2) - 3^n u(-n).$$
- (c) State Parseval's theorem of Fourier transform. 4

2. (a) Determine the step response of an LTI system whose impulse response is given by 7

$$h(n) = (-1)^n [u(n+2) - u(n-3)].$$

- (b) A stable and causal LTI system is described by the difference equation

$$y(n) + \frac{1}{4} y(n-1) - \frac{1}{8} y(n-2) = -2x(n) + \frac{5}{4} x(n-1)$$

Find impulse response of the system. 7

3. (a) Using the convolution property, determine the convolution $x(n) = x_1(n) * x_2(n)$ of the sequence $x_1(n) = \{1, 1, 1\}$ and $x_2(n) = \{1, 0, -1\}$. 7

- (b) Determine the inverse Fourier transform of $X(j\omega) = \frac{\sin(3\omega) \cos(\omega)}{\omega}$. 7

4. (a) Determine the continuous time Fourier transform of $x(t) = (tu(t)) * (u(t) - u(t-1))$ where $u(t)$ is the unit step function and $*$ represents convolution. 7

- (b) If $X(e^{j\omega}) = \frac{j\omega}{(1+j\omega)^2}$ then determine the discrete time Fourier transform of $x_1(n) = x(1-n) + x(-1-n)$. 7

5. (a) The input and output of a causal LTI system are related by the following differential equation :

$$\frac{\partial^2 y(t)}{\partial t^2} + \frac{6 \partial y(t)}{\partial t} + 8y(t) = 2x(t).$$

What is the response of the system if $x(t) = \frac{\partial}{\partial t} (e^{-2t} u(t))$?

7

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

7

- (i) Time Shifting
- (ii) Time Reversal

6. (a) For the following ROC, check whether the corresponding LTI system of the system

$$\text{function } H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}} \text{ is causal}$$

or non causal. Also determine its impulse response for the following ROCs :

10

- (i) $|z| > 3$
- (ii) $|z| < 0.5$

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

4

- (i) Linearity
- (ii) Scaling

7. (a) Write down the exponential form of the Fourier series of a periodic signal. 4
- (b) Derive the relation between Z-transform and DTFT. 3
- (c) Determine the inverse Z-transform of $X(z) = \frac{z+2}{2z^2 - 7z + 3}$ if the ROCs are 7
- (i) $|z| > 3$
- (ii) $|z| < \frac{1}{2}$
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