

Paper Id

131225

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BTECH
(SEM-IV) THEORY EXAMINATION 2018-19
SIGNALS AND SYSTEMS

*Time : 3 Hours**Max. Marks : 100*

Note : Be precise in your answer. In case of numerical problem assume data wherever not provided

SECTION – A

1. Attempt any five parts of the following questions: 5×4=20

- (a) Explain Time variance and static properties of a system.
- (b) Write the condition for existence of DTFT.
- (c) What is relationship between Fourier Transform and Laplace Transform?
- (d) Find even and odd part of signal $x(t) = e^{-2t}u(t)$.
- (e) Determine whether or not signal $x(t) = \cos \frac{2\pi n}{7} \sin \frac{3\pi n}{14}$ is periodic .if periodic find its fundamental period.
- (f) Determine whether or not signal $x(t) = \cos(t+1)x(t)$ is causal and time variant.

SECTION B

2. Attempt any three parts of the following questions: 3×10=30

- (a) When the input to an LTI system is $x(n) = \left(\frac{1}{3}\right)^n u(n) + 2^n u(-n + 1)$ and the corresponding $y(n) = 5 \cdot \left(\frac{1}{5}\right)^n u(n) - 5 \cdot \left(\frac{2}{3}\right)^n u(n)$.
 - (i) Find the function $H(z)$ of the system and its ROC.
 - (ii) Find the impulse response $h(n)$ of the system.
- (b) Find the continuous time Fourier transform of the Gate/Rectangular signal. Also plot its magnitude response.
- (c) Given $x(t) = 5 \cos t, y(t) = 2 e^{-t}$, find the convolution of $x(t)$ and $y(t)$ using Fourier transform.

(d) A signal $x(t)$ has the Laplace Transform $X(s) = \frac{(s+2)}{(s^2+4s+5)}$. Find the Laplace

Transform of the following signal $y(t) = x(2t-1)u(2t-1)$.

(e) Determine the Z-Transform of following sequences with ROC

(i) $x(n) = \left(\frac{1}{2}\right)^n ; 0 \leq n \leq 6$

$x(n) = 0$ otherwise

(ii) $x(n) = n^2u(n) + nu(n)$

SECTION C

3. Attempt any one parts of the following : 1×10=10

(a) (i) Determine the step response of the system described by difference equation $y(n) + 4y(n-1) + 4y(n-2) = x(n)$.

(ii) Find the response of the time invariant system with impulse response $h(n) = (1, 2, 1, -1)$ to an input signal $x(n) = (1, 2, 3, 1)$ by using Z-Transform.

(b) Suppose that $x(t) = e^{-(t-2)}u(t-2)$ and $h(t)$ is shown in Figure 1. Verify the convolution property for this pair.

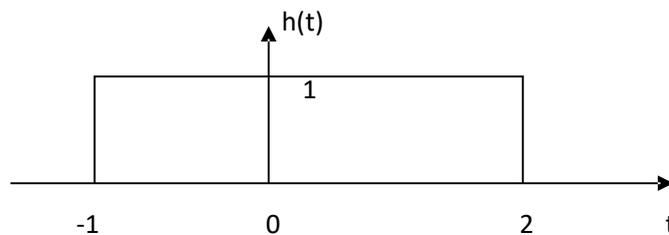


Figure 1

4. Attempt any one parts of the following : 1×10=10

(a) If $X(s) = \frac{2s+3}{(s+1)(s+2)}$ find $x(t)$ for

- i). System is stable
- ii). System is causal
- iii). System is non causal

- (b) For the discrete time system $y(n) = x(-n + 2)$ and $y(n) = x(n) + n \cdot x(n + 1)$, check whether the system is static or dynamic, linear or non-linear, shift invariant or shift varying, causal or non-causal.

5. Attempt any one parts of the following :

1×10=10

- (a) Determine the total response of the differential equation

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

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

- (b) Compute the Fourier transform of the following signals:

(1) $x(n) = 2^n u(-n)$

(2) $x(n) = \left(\frac{1}{4}\right)^n u(n + 4)$.

6. Attempt any one parts of the following :

1×10=10

- (a) Determine the inverse Z-transform using partial fraction method for

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

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

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

(3) $\frac{1}{4} < |z| < \frac{1}{2}$

- (b) Given the relationship $y(t) = x(t) * h(t)$ and $g(t) = x(3t) * h(3t)$, and given that $X(t)$ has Fourier transform $X(j\omega)$ and $h(t)$ has Fourier transform $H(j\omega)$. Use Fourier transform properties to show that $g(t)$ has the form $g(t) = Ay(Bt)$. Determine the value of A & B.

7. Attempt any one parts of the following :

1×10=10

- (a) Compute the DTFT of $x(n) = (b^n \sin \omega_0 n) u(n)$; $b < 1$.

- (b) (i) Determine output response of system $h(n) = (1,0,1,0)$ for input $x(n) = (1,2,3,4)$.

- (ii) Give and explain the relation between S-plane and Z-plane.