Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EE307

Course Name: SIGNALS AND SYSTEMS (EE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks Marks

1 Check theLinearity and Time-invariance of the system $y(t)= t^2x(t)$, where y(t) and x(t) are the output and input respectively. (5)

2 Define Laplace transform and show that (5)

$$\mathcal{L}\left(\frac{df(t)}{dt}\right) = s\mathcal{L}(f(t)) - f(0)$$

3 State and prove the following properties of Fourier transform: (5)

i)Time shift ii) Time scaling

4 Find the solution of the difference equation. (5)

$$y(n+1) + 2y(n) = n, y_0 = \frac{8}{9}$$

5 Find Z transform of the sequences: (5)

$$\text{i) } x_1[n] = \{3, -2, 0, 4, 2\}) \text{ii) } x_2[n] = a^{-n}u(-n-2)$$

6 Find inverse Z transform of $X(Z) = \log\left[\frac{1}{1-az^{-1}}\right]$ (5)

7 What is a random signal? Explain with an example. (5)

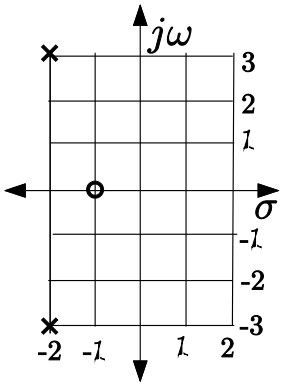
8 State and prove the discrete Fourier transform property phase shifting. (5)

PART B

Answer any two full questions, each carries 10 marks

9 a) The pole-zero plot of a system is shown in Figure 1. Obtain the differential equation model of the system. (3)

Figure 1.



b) Obtain the unit step response of the system represented by Figure 1. (No plot is required). (7)

10 a) Obtain the differential equation representation of the circuit shown in Figure 2. (4)

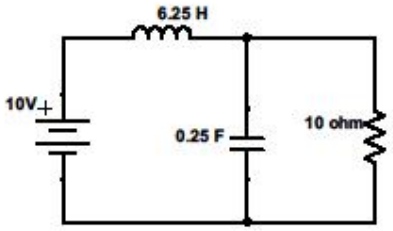


Figure 2.

b) Using Laplace transform, solve the differential equation obtained for Qn. 10(a) and get voltage across the capacitor. (Assume all initial conditions are zeros). (6)

11 a) Find $x(t) * h(t)$ where, $x(t) = u(t) - u(t-2), h(t) = e^{-2t}u(t)$ and $*$ represents the convolution operator. (5)

b) How will you determine the stability of a system from its transfer function? Comment on the stability of the following systems: (5)

i) $G_1(s) = \frac{s-2}{s^2+6s+18}$ ii) $G_1(s) = \frac{s-2}{s^2+18}$

PART C

Answer any two full questions, each carries 10 marks

12 a) Obtain complex exponential Fourier series of the signal x(t) shown in Figure 3. (5)

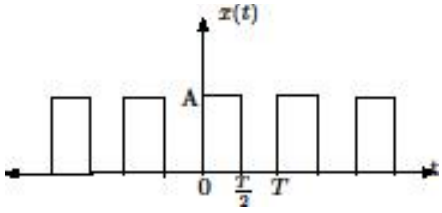


Figure 3.

b) Find the Fourier transform of $e^{-a|t|}$ (5)

13 State and prove sampling theorem. (10)

14 a) The impulse response of a system is given by $h(n) = [2\ 3\ 1]$. Find the response of the system when it is excited by the input $x(n) = u(n-1) - u(n-5)$ (6)

b) Explain energy spectral density and power spectral density. (4)

PART D

Answer any two full questions, each carries 10 marks

15 a) State and prove following properties of Z transform: (6)

i)Multiplication by n ii) Accumulation iii) Convolution

b) Find inverse z transform of (4)

$$X(z) = \frac{z}{2z^2 - 3z + 1}, |z| < \frac{1}{2}$$

16 a) State the properties (atleast eight) of discrete Fourier transform(no proof is required). (6)

b) Obtain Discrete Fouriertransform of the following signals: (4)

i) $x[n] = 0.5^n u[n]$ ii) $x[n] = 0.5^{|n|}$

17 a) Determine the stability of the following discrete transfer function: (5)

i) $H_1(z) = \frac{z}{z^2+0.7z+0.1}$ ii) $H_2(z) = \frac{z}{z^2+2.5z+1}$

b) Give any five properties of nonlinear systems. (5)

****