Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S, FE) / S2 (PT) (S, FE) Examination May 2023 (2015 Scheme)

Course Code: EC202

Course Name: SIGNALS & SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Compute the power and energy of the following signals and check whether they are power signals or energy signals. (5)

$(i) x[n] = \left(\frac{1}{3}\right)^n u[n]$

$(ii)\ y(t) = (1 + e^{-5t})u(t)$

b) Given $x(t) = u(t+1) + u(t-1) - u(t-2) - u(t-4)$. Plot $(i)\ x(t-3)$ $ii)\ x(2t-3)$ (5)

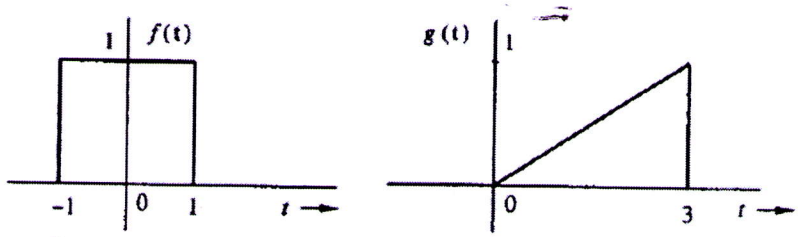
c) Show that any discrete time signal can be represented as shifted and scaled version of unit impulse function $\delta[n]$. (5)

2 a) Check whether the system $y(t) = x^2(2t)$ is (10)
(i)*Linear* (ii) *Time invariant* (iii) *Causal* (iv) *Stable*

b) State and prove BIBO stability criteria. (5)

3 a) Show that any signal can be represented as the summation of an odd and an even signal. Find the odd and even components of the signal, (7.5)
$x(n) = \{\underset{\uparrow}{-2}, 1, 2, -1, 3\}$.

b) Find the convolution of the given signals and sketch the results. (7.5)

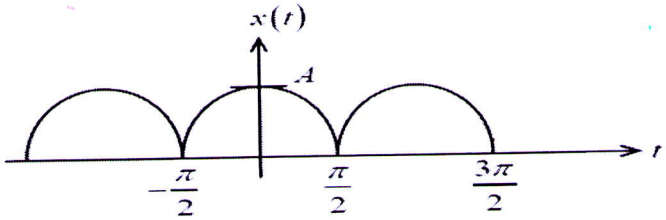


PART B

Answer any two full questions, each carries 15 marks.

4 a) State and explain Gibbs's Phenomenon. (5)

b) Obtain the exponential Fourier Series representation of a full wave rectified cosine function shown in figure. Also draw the frequency spectrum. (10)



5 a) Find the frequency response (magnitude and phase response) of a system whose transfer function is $H(s) = \frac{s+0.1}{s+5}$. Also find the value of magnitude and phase responses to the following frequencies. (7.5)

1. $Cos2t$
2. $Cos(10t - 50^0)$

b) Establish the relationship between analog and digital frequency. Also show that the maximum frequency in digital signal domain is $\omega_{max} = \pi$. (7.5)

6 a) Justify the statement with necessary examples "Sinusoids and complex exponentials are Eigen functions of a LTI system". (7.5)

b) Illustrate the effect of aliasing in time domain with the following signals (7.5)

$x_1(t) = \cos 6\pi t$, $x_2(t) = \cos 14\pi t$; $x_3(t) = \cos 26\pi t$

What value of ω you select to avoid aliasing?

PART C

Answer any two full questions, each carries20 marks.

7 a) Find the Z-transform and ROC of the following sequence (5)

1. $x[n] = \left\{\underset{\uparrow}{2}, -1, 3, 2, 0, 1\right\}$
2. $x[n] = \left\{3, 2, -1, -4, \underset{\uparrow}{1}\right\}$

b) Explain how an arbitrary discrete time periodic signal is represented as a linear combination of exponential basis function. How will you find out the coefficients? (5)

c) Find the DTFT of the rectangular pulse (10)

$$x[n] = \begin{cases} A & ; \ |n| \leq N \\ 0 & ; \ |n| > N \end{cases}$$

8 a) Plot the pole zero pattern and determine whether the following system is stable or not. $y[n] = y[n-1] - 0.5\, y[n-2] + x[n] + x[n-1]$ (7.5)

b) Find the impulse response and step response for the system (7.5)

$$y[n] = x[n] + 2x[n-1] - 4x[n-2] + x[n-3]$$

c) Establish the relationship between s-plane and z-plane. (5)

9 a) Explain with an example the role of Z-transform in system analysis. (5)

b) Determine the convolution of the sequence using DTFT. (5)

$$x_1[n] = x_2[n] = \left\{1, \underset{\uparrow}{1}, 1\right\}$$

c) Using z-transform determine the response of the linear time invariant system with difference equation (10)

$$y[n] + y[n-1] - 2y[n-2] = u[n-1] + 2u[n-2]$$

If the initial conditions are y(-1) = 0.5, y(-2)=0.25

****