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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree Examination (Regular and Supplementary), December 2020

Course Code: EE307

Course Name: SIGNALS AND SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1 Suppose $x(t) = \frac{dr(t)}{dt}$, where $r(t)$ denotes unit ramp signal. Plot the following signal $x[t+4]x[-t+4]$. (5)

2 Comment on the stability of the system with impulse response given by $h(t) = (2 + e^{-3t})u(t)$, where $u(t)$ is unit step signal. (5)

3 State the necessary conditions for the existence of Fourier Transform. Find the FT of $x(t) = te^{at}u(t)$. (5)

4 Explain the process of signal reconstruction of a sampled signal. Derive the transfer function of zero order hold? (5)

5 Determine the z transform of $x[n] = a^n u[n] - b^n u[-n-1]$ and find the ROC if (i) a>b and (ii) a<b. (5)

6 Explain briefly the mapping of s-plane to z-plane? Show the mapping of stability regions in s-plane and z-plane. (5)

7 Find the Fourier series coefficients of the discrete signal $x[n] = cos\left(\frac{\pi}{4}n\right)$? (5)

8 Write any five properties of nonlinear systems. (5)

PART B

Answer any two full questions, each carries 10 marks.

9 Comment on the linearity, causality, time-invariance and memory of a system which finds the odd component of a given signal $x(t)$, that is, $y(t) = odd(x(t))$. (10)

10 a) Consider an LTI system with impulse response $h(t) = u(t+3)$. Find the output $y(t)$, for an input $x(t) = e^{-3t}u(t)$. (5)

b) Find the fundamental period and frequency of the signal $x(t) = 6\sin 24\pi t + 8 \sin 36\pi t$. (5)

11 Find the zero state response for a system with transfer function (10)

$H(s) = \frac{s+2}{s^2+4s+3}$ if the input is $e^{-t}u(t)$.

PART C

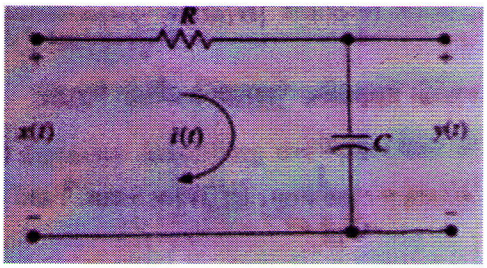
Answer any two full questions, each carries10 marks.

12 Find the complex exponential Fourier series representation of the following signal. Also plot the magnitude spectrum. (10)

$$x(t) = 4cos2\omega_0 t$$

Here $\omega_0$is the fundamental frequency in rad/sec.

13 Find the frequency response of the RC circuit shown below. Plot the magnitude and phase response for RC=1? (10)



14 a) Determine the step response of a system with impulse response given by $h[n] = a^n u[n]$. (5)

b) Consider the analog signal $x_a(t) = 2cos2000\pi t + 5sin4000\pi t + 12cos12000\pi t$. (5)

Determine the Nyquist sampling rate.

PART D

Answer any two full questions, each carries 10 marks.

15 Solve difference equation using z-transform (10)

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

with $x[n] = \left(\frac{1}{3}\right)^n u[n]$,and the initial condition $y(-1) = 1$?

16 a) Find the inverse z-transform of (5)

$$X(z) = \frac{3z^{-1}}{(1-z^{-1})(1-2z^{-1})}$$

if ROC is i) $|z| > 2$, ii) $|z| < 1$, iii) $1 < |z| < 2$

b) Write a short note on random signals and random processes. (5)

17 a) Determine the expression for magnitude and phase response of the following system $y[n] = x[n] - 2x[n-1] + x[n-2]$. (10)

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