CBCS SCHEME

USN | | | | | | | | | |

15EE54

Fifth Semester B.E. Degree Examination, June/July 2019
Signals and Systems

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain the classification of signals. **(05 Marks)**

b. For the continuous-time signal x(t) shown in Fig.Q1(a) obtain $y(t) = x(3t) + x(3t+2)$. **(05 Marks)**

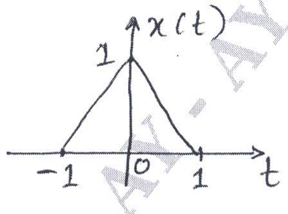

Fig.Q1(a)

c. Find odd and even components for the signals given :

i) $x(t) = (1+t^3)\cos^{10}(t)$ ii) $x(t) = 1 + t + 3t^2 + 5t^3 + 9t^4$. **(06 Marks)**

OR

2 a. Explain the properties of systems. **(05 Marks)**

b. Determine whether the continuous-time signal, $y(t) = y_1(t) + y_2(t) + y_3(t)$ is periodic ; where $y_1(t)$, $y_2(t)$ and $y_3(t)$ have periods of 1.08, 3.6 and 2.025 seconds respectively. **(05 Marks)**

c. For the following continuous-time systems, determine whether the system is i) linear ii) time invariant iii) memoryless.

1) $y(t) = x(\sin t)$ 2) $y(t) = (t + 10)\,x(t)$. **(06 Marks)**

Module-2

3 a. Derive the equation for convolution sum. **(06 Marks)**

b. The impulse response of an LTI system is given by

$h(n) = 1;\ n = \pm 1$
$= 2;\ n = 0$
$= 0;\ \text{otherwise}$

Determine the output for an input sequence $x(n) = [\underset{\uparrow}{2}, 3, -2]$. **(05 Marks)**

c. Find the forced response for the system given in Fig.Q3(c). With input $x(t) = 2e^{-t}u(t)$. **(05 Marks)**

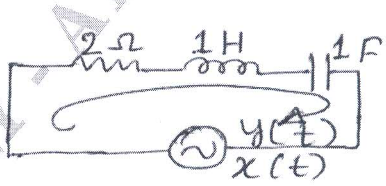

Fig.Q3(c)

OR

4 a. Prove the commutative property for convolution sum. **(06 Marks)**

b. Find the response of the system described by the difference equation $y(n) - \frac{1}{9}y(n-2) = x(n-1)$ with $y(-1) = 1$, $y(-2) = 0$, and $x(n) = u(n)$. **(05 Marks)**

c. Draw the block diagram corresponding to the LTI system described by the difference equation given by $y[n] + \frac{1}{2}y[n-1] - \frac{1}{3}y[n-3] = x[n] + 2x[n-2]$. **(05 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

5 a. State any six properties of the continuous time Fourier transform. **(06 Marks)**

b. Find the frequency response of a continuous time LTI system represented by the impulse response $h(t) = e^{-|t|}$. **(05 Marks)**

c. Find the frequency response and the impulse response of the system described the differential equation $\frac{dy(t)}{dt} + 8y(t) = x(t)$. **(05 Marks)**

OR

6 a. If $x(t) \xleftrightarrow{FT} x(j\omega)$ then prove that $y(t) = e^{j\beta t}x(t) \xleftrightarrow{FT} y(j\omega) = x(j\omega - \beta))$. **(06 Marks)**

b. Evaluate the Fourier transform for the signal, $x(t) = e^{-3t}u(t-1)$. Find the expression for magnitude and phase spectra. **(05 Marks)**

c. Find the frequency response and the impulse response of the system described by the differential equation : $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = \frac{-dx(t)}{dt}$. **(05 Marks)**

Module-4

7 a. State and prove time-shift property fo the discrete-time Fourier transform (DTFT). **(06 Marks)**

b. Find the DTFT of the signal $x(n) = \alpha^n u(n)$; $|\alpha| < 1$. Draw the magnitude spectrum. **(05 Marks)**

c. Obtain the frequency response and the impulse response of the system described by the difference equation given by $y(n) + \frac{1}{2}y(n-1) = x(n) - 2x(n-1)$. **(05 Marks)**

OR

8 a. State and prove Parseval's theorem. **(06 Marks)**

b. Find the DTFT of $\delta(n)$ and draw the spectrum. **(05 Marks)**

c. Obtain the difference equation for the system having impulse response.

$$h(n) = \delta(n) + 2\left(\frac{1}{2}\right)^n u(n) + \left(-\frac{1}{2}\right)^n u(n).$$ **(05 Marks)**

Module-5

9 a. Define RoC and explain its properties. **(06 Marks)**

b. Find the z-transform of $x(n) = \alpha^n u(n)$ and draw its RoC. **(05 Marks)**

c. Find the discrete –time sequence x(n) which has z-transform, $x(z) = \frac{-1 + 5z^{-1}}{\left(1 - \frac{3}{2}z^{-1} + \frac{1}{2}z^{-2}\right)}$ with RoC; $|z| > 1$. **(05 Marks)**

OR

10 a. State and explain final value theorem. **(06 Marks)**

b. Find x(z) if $x(n) = -\alpha^n u(-n-1)$ and find the RoC. **(05 Marks)**

c. Obtain the time domain single corresponding to the z –transform given below :

$$x(z) = \frac{\frac{1}{4}z^{-1}}{\left(1 - \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}\right)};|z| > \frac{1}{2}.$$ **(05 Marks)**