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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)

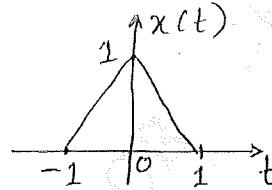


Fig.Q1(a)

- 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  $x(n) = [2, 3, -2]$ . (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)

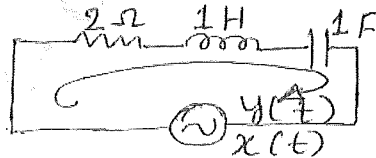


Fig.Q3(c)

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  $x(t) \xrightarrow{\text{FT}} X(j\omega)$  then prove that  $y(t) = e^{j\beta t} x(t) \xrightarrow{\text{FT}} Y(j\omega) = X(j\omega - \beta)$ . (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:  $\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 6y(t) = -\frac{dx(t)}{dt}$ . (05 Marks)

**Module-4**

- 7 a. State and prove time-shift property for 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)