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10EE52

Fifth Semester B.E. Degree Examination, May 2017
Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define a signal and system. **(05 Marks)**

b. Distinguish between (i) Power and Energy signals and (ii) Even and Odd signals. **(05 Marks)**

c. Check whether the following signals are periodic or not. If periodic, find their fundamental period.

(i) $x(n) = \cos\left(\frac{4\pi n}{3}\right)$ (ii) $x(t) = 3\cos 4t$ **(05 Marks)**

d. For the signal x(t) shown in Fig.Q1(d), plot $x(t-1) + x(-t+3)$ **(05 Marks)**

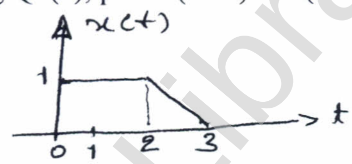

Fig.Q1(d)

2 a. Find the convolution of the following signals:

$x(t) = e^{-2t}u(t)$, $h(t) = u(t+2)$ **(10 Marks)**

b. Find the response of the system for input $x(n) = u(n)$ whose impulse response $h(n) = \alpha^n u(n)$; $0 < \alpha < 1$. Also plot the output signal y(n). **(10 Marks)**

3 a. Check whether the systems characterized by the following impulse responses are (i) causal (ii) stable and (iii) memory less.

(a) $h(n) = 3\,\delta(n)$ (b) $h(t) = e^{-2t}u(t-1)$ **(06 Marks)**

b. Draw the direct form – I and direct form – II realizations for the system described by the difference equation $y(n) + \frac{1}{2}y(n-1) - y(n-3) = 3x(n-1) + 2x(n-2)$ **(06 Marks)**

c. Obtain the output of the system given by the differential equation

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$$

$$y(0) = 0; \quad \left.\frac{dy(t)}{dt}\right|_{t=0} = 1 \quad \text{and} \quad x(t) = e^{-2t}u(t).$$ **(08 Marks)**

4 a. State and prove the following properties of continuous time fourier series:

(i) Linearity (ii) Convolution (iii) Frequency shift. **(12 Marks)**

b. Determine D.T.F.S representation for the signal $x(n) = \cos\left(\frac{n\pi}{3}\right)$. Plot the spectrum of x(n). **(08 Marks)**

PART – B

5 a. Find the fourier transform for the following :
(i) $x(t) = \delta(t)$ (ii) $x(t) = e^{-3t}\,u(t-1)$ (iii) $x(t) = e^{at}\,u(-t)$ **(09 Marks)**

b. Determine the inverse F.T. of the following using partial fraction expansion :

$$X(jw) = \frac{5jw+12}{(jw)^2+5jw+6}$$ **(05 Marks)**

c. Find the frequency response and impulse response of the system described by the differential equation $\frac{d}{dt}y(t)+8y(t)=x(t)$ **(06 Marks)**

6 a. Find the D.T.F.T of the following :

(i) $x(n) = \left(\frac{1}{2}\right)^n [u(n+3)-u(n-2)]$

(ii) $x(n) = a^n\,u(n)$; $|a| < 1$

(iii) $x(n) = u(n) - u(n-6)$ **(09 Marks)**

b. Obtain difference equation description for the system having impulse response
$h(n) = \delta(n) + 2(½)^n\,u(n) + (-½)^n\,u(n)$. **(06 Marks)**

c. State and prove Parseval's theorem of D.T.F.T. **(05 Marks)**

7 a. What is R.O.C? List the properties of R.O.C. **(06 Marks)**

b. Find the Z-transform of the following :
(i) $x(n) = n\,a^{n-1}\,u(n)$ (ii) $x(n) = (1/2)^n\,u(n) + (1/3)^n\,u(n)$
(iii) $x(n) = (1/2)^n\,u(n-2)$ **(09 Marks)**

c. Find the inverse Z-transform of $x(z) = \dfrac{z^2-3z}{z^2+\frac{3}{2}z-1}$; ROC $|z| > 2$ **(05 Marks)**

8 a. Find the transfer function and impulse response of the system described by the difference equation $y(n) - ½\,y(n-1) = 2x(n-1)$ **(06 Marks)**

b. Determine whether the system described below is causal and stable

$$H(z) = \frac{2z+1}{z^2+z-\frac{5}{16}}$$ **(04 Marks)**

c. Solve the following difference equation using unilateral z-transform

$y(n) - \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = x(n)$; $n \geq 0$; with initial conditions $y(-1) = 4$, $y(-2) = 10$

and $x(n) = \left(\frac{1}{4}\right)^n u(n)$. **(10 Marks)**

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