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10EE52

Fifth Semester B.E. Degree Examination, July/August 2021
Signals and Systems

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Explain the following i) Continuous time and discrete time signals ii) Even and odd signals Give examples. (05 Marks)
 - b. Sketch the signal $x(t) = -u(t+3) + 2u(t+1) - 2u(t-1) + u(t-3)$. (05 Marks)
 - c. $x(n)$ is a signal with real part $x_e(n)$ and odd part as $x_o(n)$, prove that : (05 Marks)
- $$\sum_{n=-\infty}^{\infty} x^2(n) = \sum_{n=-\infty}^{\infty} x_e^2(n) + \sum_{n=-\infty}^{\infty} x_o^2(n).$$
- d. If $y(n) = \log_{10}(|x(n)|)$, check for linearity, time invariance, memory, causality and stable properties. (05 Marks)
- 2 a. Given that $x(n) = (1, 2, 3, 4)$ and $h(n) = (1, 2, 1, 2)$. Determine the output $y(n)$ using graphical method and linearity-time shifting method. (10 Marks)
 - b. Determine the discrete convolution sum if $x(n) = \left(\frac{1}{2}\right)^n \cdot u(n-2)$ and $h(n) = u(n)$. Explain the calculation of K for different values of n from the graphs of $x(n)$ and $h(n)$. (10 Marks)
- 3 a. For a continuous time system, the impulse response is given by, $h(t) = e^{-3t} \cdot u(t-1)$ check for stable and causal properties. (05 Marks)
 - b. Solve the following difference equation using time domain approach. (10 Marks)
- $$y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + x(n-1) \text{ where } x(n) = \left(\frac{1}{8}\right)^n \cdot u(n) \text{ with } y(-1) = 0 \text{ and } y(-2) = 0.$$
- c. A continuous time system is given by $\frac{d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$. Draw direct form – I and direct form II structures. (05 Marks)
- 4 a. Determine the DTFS representation for the signal $x(n)$ shown in Fig.4(a) and sketch the spectrum of magnitude and phase of $X(K)$. Verify Parseval's identity. (10 Marks)

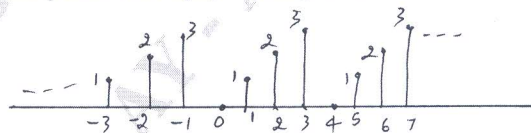


Fig.Q4(a)

- b. Determine the Fourier series for the signal $x(t) = \sin(2\pi t) + \cos(3\pi t)$. Draw the magnitude and phase spectrum. (05 Marks)
- c. Calculate the Fourier series representation of impulse train as in Fig.Q4(c). Draw the spectrum. (05 Marks)

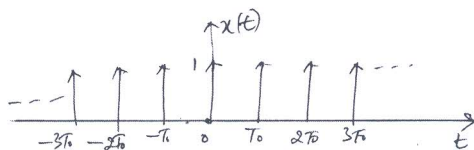


Fig.Q4(c)

1 of 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.

- 5 a. With respect to Fourier transform, state and prove the following properties :
 i) Time differentiation
 ii) Frequency differentiation. (10 Marks)
- b. Find the Fourier transform for $x(t) = e^{-3t} \cdot u(t-1)$. Write expressions for magnitude and phase. (05 Marks)
- c. Find the time domain signal for the spectrum shown in Fig.Q5(c).

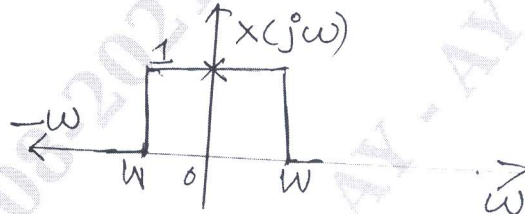


Fig.Q5(c)

(05 Marks)

- 6 a. Calculate DTFT of the signal :
 i) $x(n) = 2^n \cdot u(-n)$
 ii) $x(n) = \left(\frac{1}{4}\right)^n \cdot u(n+4)$. (10 Marks)
- b. Find the differential equation for the system having $h(t) \Rightarrow$ i.e $h(t) = \frac{1}{a} e^{-t/a} \cdot u(t)$. (05 Marks)
- c. Find the Fourier transform representation for the signal $x(t) = \cos \omega_0 t$ and draw the spectrum. (05 Marks)
- 7 a. Find the Z-transform and state ROC for :
 i) $x(n) = \alpha^{|n|}$, where $|\alpha| < 1$
 ii) $x(n) = (-1)^n \cdot 2^{-n} \cdot u(n)$. (10 Marks)
- b. Determine inverse z-transform using partial fraction expansion method if $x(z) = \frac{4 - 3z^{-1} + 3z^{-2}}{(1 + 2z^{-1})(1 - 3z^{-1})^2}$. Show the calculation of constants in detail. (07 Marks)
- c. Determine IZT if $X(Z) = \cos(2Z)$ where $|Z| < \infty$. Use power series expansion method. (03 Marks)
- 8 a. Using Z-transform method solve the difference equations :
 $Y(n) - \frac{5}{6} y(n-1) + \frac{1}{6} y(n-2) = x(n)$ where $x(n) = 2^n \cdot u(n)$. (10 Marks)
- b. A system has impulse response $h(n)$ given by $h(n) = \left(\frac{1}{2}\right)^n u(n)$. Find the input to the system if the output is given by, $y(n) = \frac{1}{3} \cdot u(n) + \frac{2}{3} \left(-\frac{1}{2}\right)^n \cdot u(n)$. (10 Marks)
