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10EE52

Fifth Semester B.E. Degree Examination, June/July 2017
Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define signals and systems with an example. **(04 Marks)**

b. Check whether the following singles are periodic. **(04 Marks)**
i) $x(t) = \sin^2 \pi t$ ii) $x(n) = \sin(\pi/3\, n) \cos(\pi/3\, n)$.

c. For the signal shown in Fig Q1(c). Find the output $y(t) = x_1(t) * x_2(t)$. **(04 Marks)**

Fig 1 (c)

d. The continuous time signal

$$x(t) = \begin{cases} \frac{-2}{3}t + 2 & ; \quad 0 \le t \le 3 \\ 0 & ; \quad \text{elsewhere} \end{cases}$$

Sketch x(t) and find the following signals. i) $y_1(t) = x(2t-2)$ ii) $y_2(t) = x[1/2\,(t-2)]$ iii) $y_3(t)\,[-0.5\,t - 1]$ iv) $x_e(t)$ and $x_o(t)$. **(08 Marks)**

2 a. Check whether of following signals are linear, Time invariant, memory less, causal and stable. i) $y(t) = \log x(t)$ iii) $y(n) = x(-n)$ **(08 Marks)**

b. Determine and sketch the output signal using convolution sum.
Given $x(n) = (1/2)^n u(n-2)$ and $h(n) = u(n)$. **(08 Marks)**

c. Determine the range of 'a' and 'b' for which the LTI system with impulse response

$$h(n) = \begin{cases} a^n & ; \quad n \ge 0 \\ b^n & ; \quad n < 0 \end{cases}$$ is stable. **(04 Marks)**

3 a. Determine the complete 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 input $x(n) = u(n)$. **(08 Marks)**

b. Draw the direct form – I and II for the following differential equations
i) $\dot{y} + 5y = 3x$ ii) $\ddot{y} + 5\dot{y} + 4y = \dot{x}$ **(06 Marks)**

c. For the network shown in Fig Q3(c). find natural response of the system with initial conditions $y(0) = 3$ and $\dot{y}(0) = -5$ **(06 Marks)**

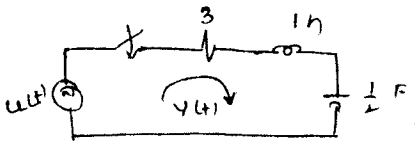

Fig Q3(c)

4 a. State and prove following properties of continuous time Fourier series (CTFS)
i) Time shift ii) Parasvel's theorem. **(06 Marks)**

b. Find the complex exponential Fourier series and plot magnitude and phase spectrum.

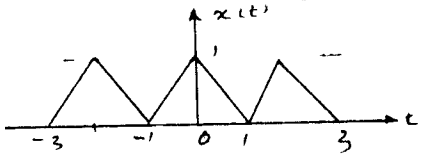

Fig Q4(b)

(08 Marks)

c. Determine the discrete time Fourier series representation for the signal

$$x(n) = \cos\left(\frac{\pi}{3}n\right)$$ **(06 Marks)**

PART – B

5 a. State and prove following properties of Fourier Transformation.
i) Frequency shift ii) Convolution theorem. **(07 Marks)**

b. Determine Fourier transformation of following signals.
i) $x(t) = e^{-at}\,u(t)$ ii) $x(t) = \cos w_0 t$. **(06 Marks)**

c. Find the frequency response and the impulse response of the system described by the differential equation.

$$\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y = -\frac{d}{dt}x(t).$$ **(07 Marks)**

6 a. State and explain following DTFT properties
i) Linearity ii) Frequency differentiation. **(06 Marks)**

b. Find the DTFT of following signals i) $(x(n) = \delta(n)$ ii) $x(n) = a^n u(n)$; $|a| < 1$ **(06 Marks)**

c. Obtain frequency response and the impulse response of the system described by the difference equation $y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = 3x(n) - \frac{3}{4}x(n-1)$ **(08 Marks)**

7 a. What is z-transformation? List the properties of ROC. **(06 Marks)**

b. State and prove following properties i) Convolution ii) Time reversal. **(06 Marks)**

c. Find the z-transformation of

i) $x(n) = n\,a^n u(-n)$ ii) $x(n) = n\sin\left(\frac{\pi}{2}n\right)u(-n)$ **(08 Marks)**

8 a. Find the inverse z-transformation of the sequence

$$x(z) = \frac{1}{1 - \frac{3}{2}z^{-1} + \frac{1}{2}z^{-2}}$$ for ROC i) $|z| > 1$ ii) $|z| < ½$ iii) $½ < |z| < 1$ **(08 Marks)**

b. Solve the following difference equation $y(n) + y(n-2) = \delta(n)$; $n \geq 0$ with $y(-2) = 0$ and $y(-1) = 1$. **(06 Marks)**

c. Find the transfer function and impulse response of the system described by the difference equation $y(n) - \frac{1}{4}y(n-1) - \frac{3}{8}y(n-2) = x(n) + 2x(n-1)$. **(06 Marks)**

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