CBCS Scheme

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15EC44

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Signals and Systems

Time: 3 hrs. Max. Marks: 80

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

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-1

1 a. Find odd and even components of the following signals.
i) $x(t) = 1 + t \cos t + t^2 \sin t + t^3 \cos^2 t \sin t$
ii) $x(t) = 1 + t^2 \cos^2 t + t^3 \sin^3 t + t^4 \cos t$. **(08 Marks)**

b. For the signal x(t) shown in Fig.Q1(b) find and plot.
i) $x(-2t - 4)$ ii) $x(-3t + 2)$ iii) $x(2(-t - 1))$. **(08 Marks)**

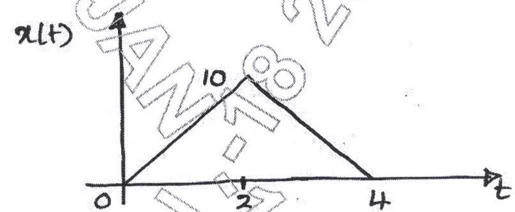

Fig.Q1(b)

OR

2 a. Determine whether the system described by the following input/output relationship is memoryless, causal, time – invariant or linear.

i) $y(n) = e^{x(n)}$ ii) $y(t) = \frac{1}{C} \int_{-\infty}^{t} x(\tau) d\tau$. **(08 Marks)**

b. Given the signal $x(n) = (8 - n)[u(n) - u(n - 8)]$. Find and sketch
i) $y_1(n) = x[4 - n]$ ii) $y_2(n) = x[2n - 3]$. **(08 Marks)**

Module-2

3 a. Find the convolution integral of $x_1(t) = e^{-2t} u(t)$ and $x_2(t) = u(t + 2)$. **(08 Marks)**

b. Find $y(n) = \beta^n u(n) * \alpha^n u(n)$. Given : $|\beta| < 1$ and $|\alpha| < 1$. **(04 Marks)**

c. Find $y(n) = x_1(n) * x_2(n)$

Where $x_1(n) = \{\underset{\uparrow}{1}, 2, 3\}$ and

$x_2(n) = \{1, 2, \underset{\uparrow}{3}, 4\}$. **(04 Marks)**

OR

4 a. Convolute the two continuous time signals $x_1(t)$ and $x_2(t)$ given below :
$x_1(t) = \cos \pi t[u(t + 1) - u(t - 3)]$ and $x_2(t) = u(t)$. **(08 Marks)**

b. Evaluate $y(n) = \beta^n u(n) * u(n - 3)$ given: $|\beta| < 1$. **(04 Marks)**

c. Show that : i) $x(n) * \delta(n) = x(n)$ ii) $x(n) * \delta(n - n_0) = x(n - n_0)$. **(04 Marks)**

Module-3

5 a. Check the following systems for memory less, causality and stability :
i) $h(n) = (-0.25)^{|n|}$ ii) $h(t) = e^{2t}\,u(t-1)$. **(06 Marks)**

b. Find the step response of an LTI system whose impulse response is defined by $h(n) = \frac{1}{3}\sum_{k=0}^{2}\delta(n-k)$. **(04 Marks)**

c. Evaluate the DTFS representation for the signal $x(n) = \sin\left(\frac{4\pi}{21}n\right) + \cos\left(\frac{10\pi}{21}n\right) + 1$. Also draw its magnitude and phase spectra. **(06 Marks)**

OR

6 a. Find the step response of an LTI system whose impulse response is given by
i) $h(t) = e^{-|t|}$ ii) $h(t) = t^2 u(t)$. **(06 Marks)**

b. State any six properties of DTFS. **(06 Marks)**

c. Determine DTFS of the signal $x(n) = \cos\left(\frac{\pi}{3}n\right)$. Also draw its spectra. **(04 Marks)**

Module-4

7 a. Obtain the Fourier transform of the signal $x(t) = e^{-at}u(t)$; $a > 0$. Also draw its magnitude and phase spectra. **(06 Marks)**

b. Find the DTFT of the signal $x(n) = \alpha^n u(n)$; $|\alpha| < 1$. Also draw its magnitude spectra. **(04 Marks)**

c. Find the FT representation for the periodic signal $x(t) = \cos\omega_0 t$ and also draw its spectrum. **(06 Marks)**

OR

8 a. Find the FT of the signum function $x(t) = s_g n(t)$. Draw the magnitude and phase spectra. **(06 Marks)**

b. Find the DTFT of $\delta(n)$ and draw the spectrum. **(04 Marks)**

c. Find the FT of the periodic impulse train $\delta_{T_0}(t) = \sum_{k=-\infty}^{\infty}\delta(t - kT_0)$ and draw the spectrum. **(06 Marks)**

Module-5

9 a. Find Z.T of the following sequences and als sketch their RoC :
i) $x(n) = \sin\Omega_0 n\, u(n)$ ii) $x(n) = (\frac{1}{2})^n u(n) + (-2)^n u(-n-1)$. **(08 Marks)**

b. Find IZT of the following sequence $x(z) = \dfrac{\left(\frac{1}{4}\right)z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)}$ with RoC $\frac{1}{4} < |z| < \frac{1}{2}$. **(08 Marks)**

OR

10 a. State and prove the following properties of ZT
i) Time reversal property ii) differentiation property. **(08 Marks)**

b. Find IZT of the following sequence using partial fraction expansion method :

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

Given : i) RoC : $|z| < \frac{1}{2}$; ii) RoC : $|z| > 1$; iii) RoC : $\frac{1}{2} < |z| < 1$. **(08 Marks)**

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