CBCS SCHEME

USN | | | | | | | | | | | **17EC42**

Fourth Semester B.E. Degree Examination, June/July 2019

Signals and Systems

Time: 3 hrs. Max. Marks: 100

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. Determine whether the signal $x(n) = \cos\frac{4\pi n}{6} + \sin\frac{2\pi n}{8}$ is periodic or not. If periodic, find the fundamental period. **(05 Marks)**

b. Let x(t) and y(t) be given in Fig.Q1(b). Sketch the signal $x(2t) * y(\frac{1}{2}t + 1)$. **(08 Marks)**

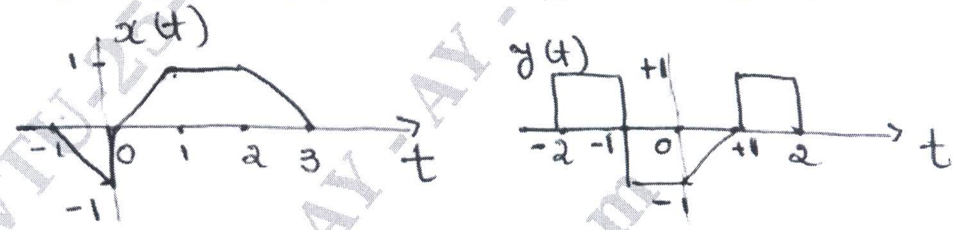

Fig.Q1(b)

c. Express x(t) in terms of g(t). x(t) and g(t) are shown in Fig.Q1(c). **(07 Marks)**

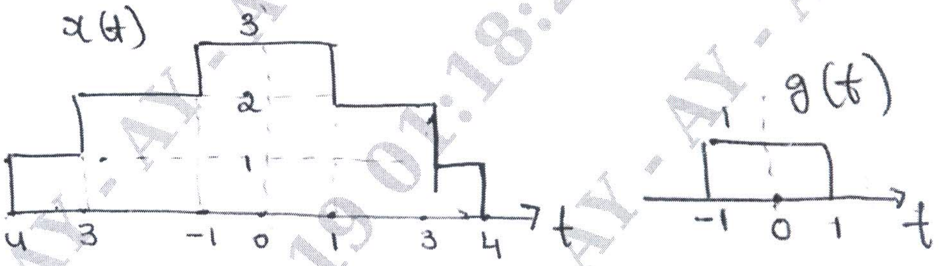

Fig.Q1(c)

OR

2 a. Sketch the waveforms of the signal $x(t) = u(t+1) - 2u(t) + u(t-1)$. **(04 Marks)**

b. Determine even and odd component of the signal x(n) shown in Fig.Q2(b). **(06 Marks)**

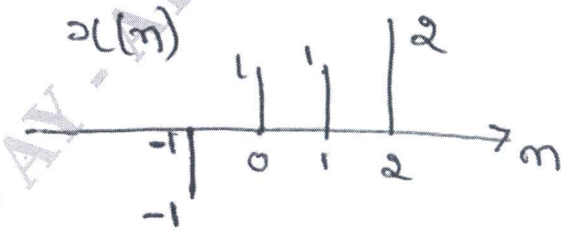

Fig.Q2(b)

c. Find whether the systems $y(t) = x(t/2)$ and $y[n] = e^{x[n]}$ are memoryless, stable, casual, linear and time invariant. **(10 Marks)**

Module-2

3 a. Derive the expression of convolution sum. **(05 Marks)**

b. Compute the response of a discrete LTI system having impulse response $h(n) = [u(n) - u(n-3)]$ and $x(n) = [u(n+1) - u(n-3)]$. **(10 Marks)**

c. State and prove associative property of convolution sum. **(05 Marks)**

OR

4 a. Perform the convolution of $x(t) = e^{-2t}u(t)$ with $h(t) = u(t)$. **(07 Marks)**

b. State and prove distributive property of convolution integral. **(05 Marks)**

c. Find the convolution of the signal $x(n) = \alpha^n u(n)$ with the signal $h(n) = \beta^n u(n)$. Where $|\alpha| < 1$ and $|\beta| < 1$. **(08 Marks)**

Module-3

5 a. Evaluate the step response of LTI systems represented by impulse response $h(t) = e^{-|t|}$. **(05 Marks)**

b. Define Fourier series. State time shift, convolution and Parreval's theorem properties of Fourier series. **(05 Marks)**

c. Evaluate the DTFS of the signal $x(n) = 2\sin\left(\frac{14\pi}{19}n\right) + \cos\left(\frac{10\pi}{19}n\right) + 1$. **(10 Marks)**

OR

6 a. Write the statement of Linearity, freqshift multiplication in time properties of DTFS. **(03 Marks)**

b. Find DTFS of the signal x(n) shown in Fig. Q6(b) and also sketch the magnitude and phase spectrum. **(10 Marks)**

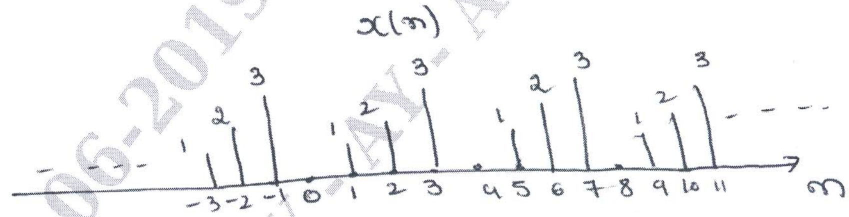

Fig.Q6(b)

c. Compute the Fourier series of the signal x(t) shown in Fig.Q6(C). **(07 Marks)**

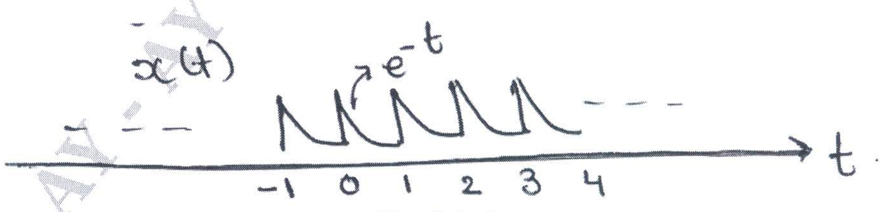

Fig.Q6(c)

Module-4

7 a. Find the Fourier transform of the signal $x(t) = \sin w_c t\, u(t)$. **(07 Marks)**

b. State and prove differentiation in time property of Fourier transform. **(05 Marks)**

c. Evaluate inverse DTFT of the signal $x(e^{j\Omega}) = \dfrac{6}{e^{-j2\Omega} - 5e^{-j\Omega} + 6}$. **(08 Marks)**

OR

8 a. Define sampling theorem. Determine the Nyquist rate and Nyquist interval for the signal $x(t) = \cos\pi t + 3\sin 2\pi t + \sin 4\pi t$. **(06 Marks)**

b. Compute inverse FT of $X(j\omega) = \dfrac{2j\omega + 1}{(j\omega + 2)^2}$. **(06 Marks)**

c. Find DTFT of the signal $x(n) = \left(\dfrac{1}{2}\right)^n u(n) - \left(\dfrac{1}{3}\right)^n u(-n-3)$. **(08 Marks)**

Module-5

9 a. State and prove differentiation in Z-domain property of z-transform. **(05 Marks)**

b. Find the z-transform of the signal $x(n) = n(\frac{1}{2})^n u(n)$. **(05 Marks)**

c. Compute inverse Z –transform of the signal $x(z) = \dfrac{\left(\frac{1}{4}\right)z^{-1}}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{4}z^{-1}\right)}$ for ROC $|z| > \frac{1}{2}$; $\frac{1}{4} < |z| < \frac{1}{2}$. **(10 Marks)**

OR

10 a. Define ROC. Explain the properties of ROC along with example. **(10 Marks)**

b. A discrete LTI system is characterized by the different equation
$y(n) = y(n-1) + y(n-2) + x(n-1)$
Find the system function H(z) and indicate the ROC if the system is stable. Also determine the unit sample response of the stable system. **(10 Marks)**

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