

CBGS SCHEME

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.

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)

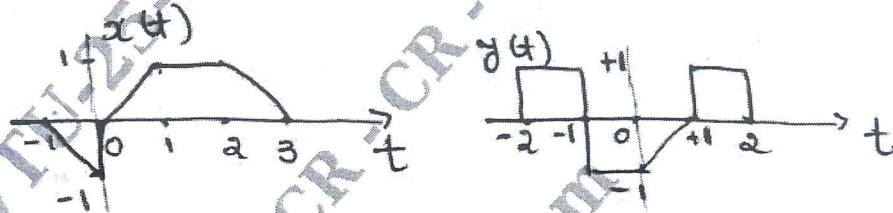


Fig.Q1(b)

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

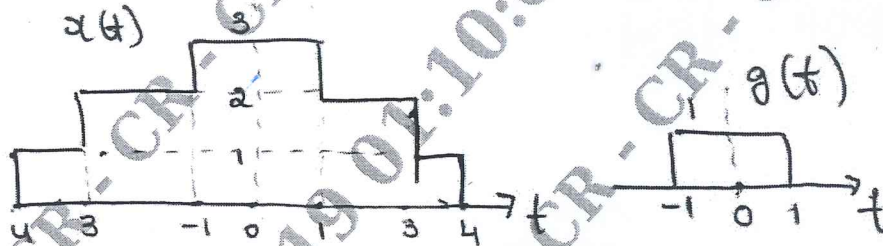


Fig.Q1(c)

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)

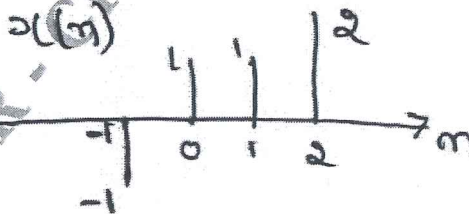


Fig.Q2(b)

- 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 Parseval'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)

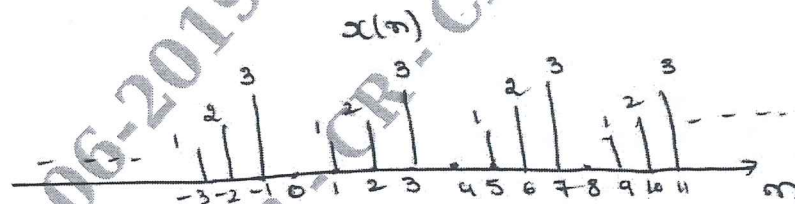


Fig. Q6(b)

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

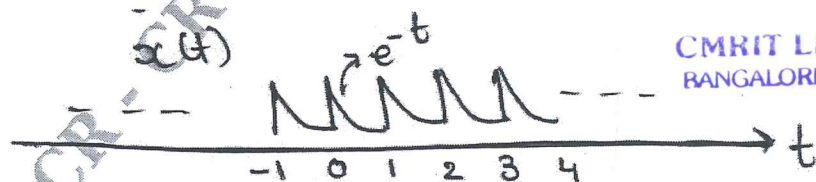


Fig. Q6(c)

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Module-4

- 7 a. Find the Fourier transform of the signal $x(t) = \sin \omega_c t u(t)$. (07 Marks)
 b. State and prove differentiation in time property of Fourier transform. (05 Marks)
 c. Evaluate inverse DTFT of the signal $x(e^{j\Omega}) = \frac{6}{e^{-j2\Omega} - 5e^{-j\Omega} + 6}$. (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 $X(j\omega) = \frac{2j\omega + 1}{(j\omega + 2)^2}$. (06 Marks)
 c. Find DTFT of the signal $x(n) = \left(\frac{1}{2}\right)^n u(n) - \left(\frac{1}{3}\right)^n u(-n-3)$. (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 $x(n) = n\left(\frac{1}{2}\right)^n u(n)$. (05 Marks)
 c. Compute inverse Z-transform of the signal $x(z) = \frac{\left(\frac{1}{4}\right)z^{-1}}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{4}z^{-1}\right)}$ 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)
