

CBCS Scheme

USN

--	--	--	--	--	--	--	--	--	--

15EC44

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

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Sketch the even and odd part of the signals shown in Fig. Q1(a) and (b). (08 Marks)

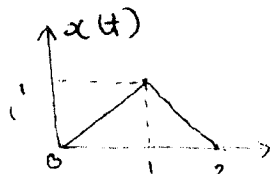


Fig. Q1(a)

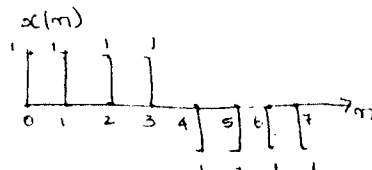


Fig. Q1(b)

- b. Determine whether the following signal is periodic or not if periodic find the fundamental period. $x(n) = \cos\left(\frac{n\pi}{5}\right)\sin\left(\frac{n\pi}{3}\right)$ (03 Marks)
- c. Express $x(t)$ in terms $g(t)$ if $x(t)$ and $g(t)$ are shown in Fig. Q1(c). (05 Marks)

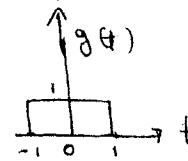
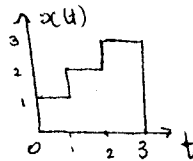


Fig. Q1(c)

OR

- 2 a. Determine whether the following systems are memory less, causal, time invariant, linear and stable. i) $y(n) = n x(n)$ ii) $y(t) = x(t/2)$. (08 Marks)
- b. For the signal $x(t)$ and $y(t)$ shown in Fig. Q2(b) sketch the following signals.
i) $x(t+1) \cdot y(t-2)$ ii) $x(t) \cdot y(t-1)$ (08 Marks)

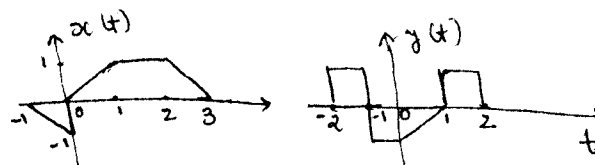


Fig. Q2(b)

Module-2

- 3 a. Prove the following :
- i) $x(n) * [h_1(n) + h_2(n)] = x(n) * h_1(n) + x(n) * h_2(n)$
- ii) $x(n) * u(n) = \sum_{k=-\infty}^n x(k)$. (08 Marks)
- b. Compute the convolution sum of $x(n) = u(n) - u(n-8)$ and $h(n) = u(n) - u(n-5)$. (08 Marks)

Important Note: On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.

OR

- 4 a. State and prove the associative, integral and commutative properties of convolution. (08 Marks)
 b. Compute the convolution integral of $x(t) = u(t) - u(t - 2)$ and $h(t) = e^{-t} u(t)$. (08 Marks)

Module-3

- 5 a. A system consists of several subsystems connected as shown in Fig. Q5(a). Find the operator H relating $x(t)$ to $y(t)$ for the following sub system operators. (04 Marks)

- $H_1 : y_1(t) = x_1(t) x_1(t - 1)$
 $H_2 : y_2(t) = |x_2(t)|$
 $H_3 : y_3(t) = 1 + 2x_3(t)$
 $H_4 : y_4(t) = \cos(x_4(t))$

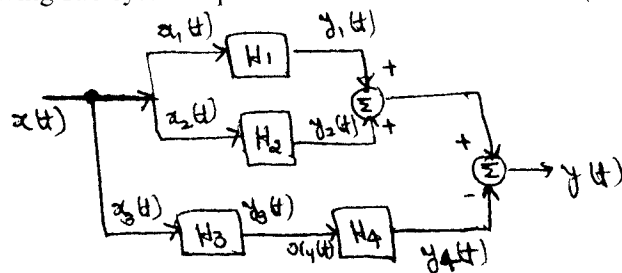


Fig. Q5(a)

- b. Determine whether the following systems defined by their impulse responses are causal, memory less and stable.
 i) $h(t) = e^{-2t} u(t - 1)$ ii) $h(n) = 2u[n] - 2u(n - 5)$ (06 Marks)
 c. Evaluate the step response for the LTI systems represented by the following impulse responses. i) $h(t) = u(t + 1) - u(t - 1)$ ii) $h(n) = \left(\frac{1}{2}\right)^n u(n)$. (06 Marks)

OR

- 6 a. State the following properties of CTFS. i) Time shift ii) Differentiation in time domain
 iii) Linearity iv) Convolution v) Frequency shift vi) Scaling. (06 Marks)
 b. Determine the DTFS coefficients for the signal shown in Fig.Q6 (b) and also plot $|x(k)|$ and $\arg\{x(k)\}$. (10 Marks)

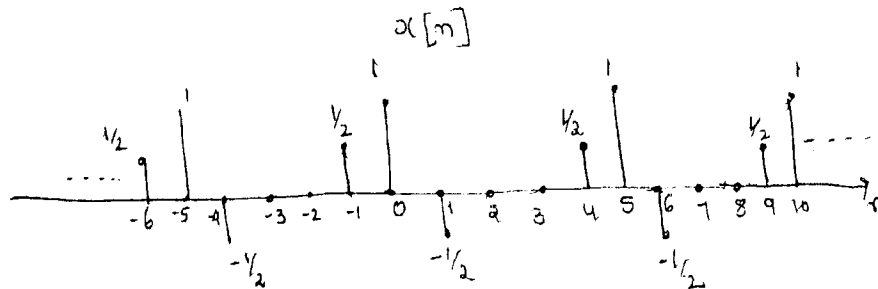


Fig. Q6(b)

Module-4

- 7 a. State and prove the following properties :
 i) $y(t) = h(t) * x(t) \xrightarrow{FT} y(j\omega) = x(j\omega)H(j\omega)$
 ii) $\frac{d}{dt} x(t) \xrightarrow{FT} j\omega x(j\omega)$ (06 Marks)

b. Find DTFT of the following signals.

i) $x(n) = \{1, 2, 3, 2, 1\}$ ii) $x(n) = \left(\frac{3}{4}\right)^n u[n]$. (10 Marks)

OR

- 8 a. Specify the Nyquist rate for the following signals
 i) $x_1(t) = \sin(200\pi t)$ ii) $x_2(t) = \sin(200\pi t) + \cos(400\pi t)$. (04 Marks)
- b. Use partial fraction expansion to determine the time domain signals corresponding to the following FTs.
- i) $x(j\omega) = \frac{-j\omega}{(j\omega)^2 + 3j\omega + 2}$
- ii) $x(j\omega) = \frac{j\omega}{(j\omega + 2)^2}$ (08 Marks)
- c. Find FT of the signal $x(t) = e^{-2t} u(t - 3)$. (04 Marks)

Module-5

- 9 a. Explain properties of ROC with example. (06 Marks)
- b. Determine the z-transform of the following signals
- i) $x(n) = \left(\frac{1}{4}\right)^n u(n) - \left(\frac{1}{2}\right)^n u(-n-1)$
- ii) $x(n) = n \left(\frac{1}{2}\right)^n u(n)$ (10 Marks)

OR

- 10 a. Find the time domain signals corresponding to the following z-transforms.

$$x(z) = \frac{\left(\frac{1}{4}\right)z^{-1}}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{4}z^{-1}\right)} \text{ with ROC } \frac{1}{4} < |z| < \frac{1}{2}. \quad (06 \text{ Marks})$$

- b. Determine the transfer function and the impulse response for the causal LTI system described by the difference equation

$$y(n) - \frac{1}{4}y(n-1) - \frac{3}{8}y(n-2) = -x(n) + 2x(n-1) \quad (10 \text{ Marks})$$

* * * * *