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.

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

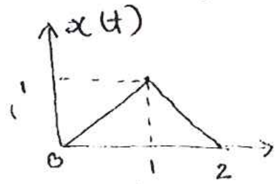

Fig. Q1(a)

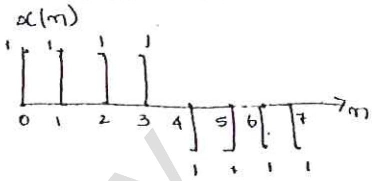

Fig. Q1(b)

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)**

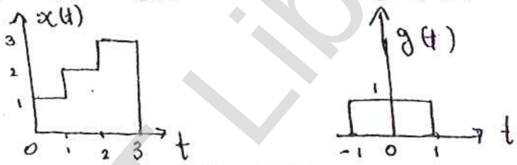

Fig. Q1(c)

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)**

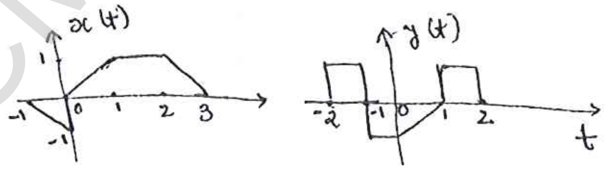

Fig. Q2(b)

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)**

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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)**

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

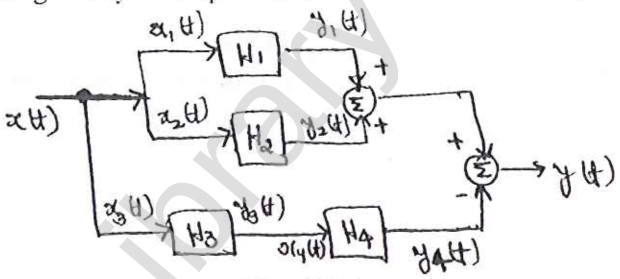

Fig. Q5(a)

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)**

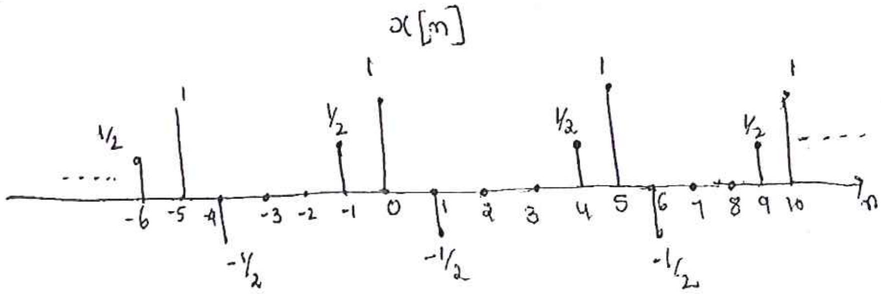

Fig. Q6(b)

Module-4

7 a. State and prove the following properties :

i) $y(t) = h(t) * x(t) \xleftrightarrow{FT} y(jw) = x(jw)H(jw)$

ii) $\frac{d}{dt}x(t) \xleftrightarrow{FT} jw\,x(jw)$ **(06 Marks)**

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b. Find DTFT of the following signals.

i) $x(n) = \{1, 2, \underset{\uparrow}{3}, 2, 1\}$ 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) $x(jw) = \dfrac{-jw}{(jw)^2 + 3jw + 2}$

ii) $x(jw) = \dfrac{jw}{(jw + 2)^2}$ **(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.

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

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

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

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