CBCS Scheme

15EC44

USN ☐☐☐☐☐☐☐☐☐☐

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)**
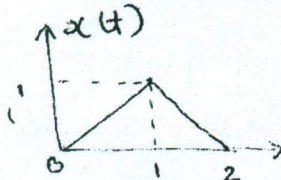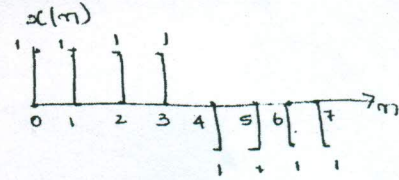

Fig. Q1(a)   Fig. Q1(b)

b. Determine whether the following signal is periodic or not if periodic find the fundamental period. $x(n) = \cos\left(\dfrac{n\pi}{5}\right)\sin\left(\dfrac{n\pi}{3}\right)$ **(03 Marks)**

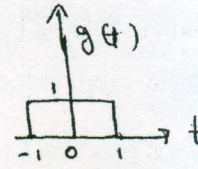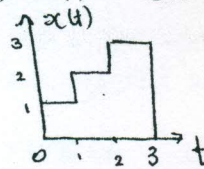c. Express x(t) in terms g(t) if x(t) and g(t) are shown in Fig. Q1(c). **(05 Marks)**

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)**
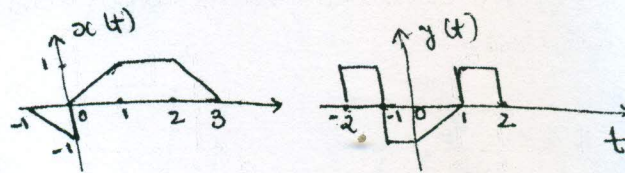

Fig. Q2(b)

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) $x(n) * u(n) = \displaystyle\sum_{k=-\infty}^{n} x(k)$. **(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)**

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)

$H_1 : y_1(t) = x_1(t) \, x_1(t - 1)$

$H_2 : y_2(t) = |x_2(t)|$

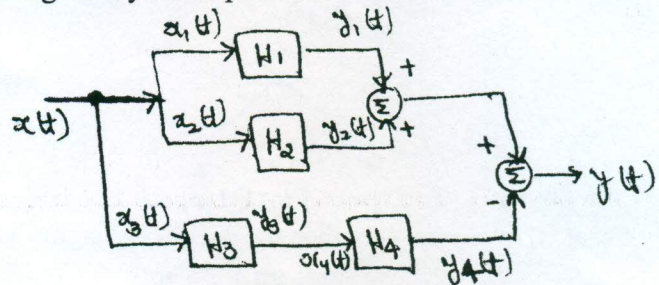$H_3 : y_3(t) = 1 + 2x_3(t)$

$H_4 : y_4(t) = \cos(x_4(t))$

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) $h(n) = \left(\dfrac{1}{2}\right)^n u(n)$.   (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)
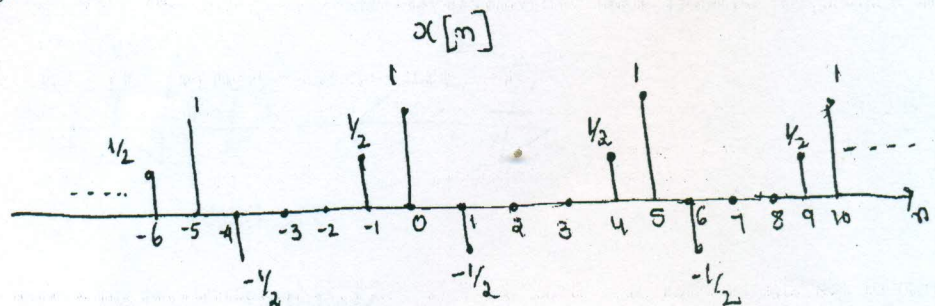

Fig. Q6(b)

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) $\dfrac{d}{dt} x(t) \xleftrightarrow{\;FT\;} jw \, x(jw)$ (06 Marks)