Sem-V / Signals & Systems / INST / 11-12-15

QP Code : 5734

(3 Hours) [Total Marks : 80

N. B. : (1) Question No. 1 is **compulsory**.
(2) Attempt any **three** questions from remaining **five** questions.
(3) Assume suitable data if necessary.

1. Solve the following :– 20

(a) Show that
$x(t) * \delta(t-to) = x(t-to)$

(b) Obtain the linear convolution of given signals. Also sketch the result.

$x(t) = 1 \quad$ for $0 \le t \le 1$
$= 0 \quad$ elsewhere
$h(t) = 1 \quad$ for $0 < t < 1$
$= -1 \quad 1 \le t \le 2$
$= 0 \quad$ elsewhere

(c) Find the z-transform of the signal

$x(n) = \left(\frac{1}{2}\right)^n \cos(w_0 n)\, u(n)$. Specify it's ROC.

(d) State and explain Dirichlets conditons for the existance of continuous time fourier series.

(e) Find the fourier transform of the signal

$$x(t) = \frac{d}{dt}\left[(e^{-3t}\, u(t)) * (e^{-2t}\, u(t-2))\right]$$

2. (a) Find if the following sequences are periodic or not. If yes find it's fundamental period. 6

(i) $x1(n) = e^{j(\pi/4)n}$
(ii) $x2(n) = 3 \sin(1/8)n$

(b) Plot the following sequences :– 10

(i) $x1(n) = (-2)^n\, u(n)$
(ii) $x2(n) = 2 + u(t-4) + u(-t)$
(iii) $x3(n) = 2^n\, u(-n-1)$

(c) Find bilateral z-transform of the signal 4
$x(n) = 9\, \delta(n+2) + 3\, \delta(n+1) - 4\, \delta(n) + 3\delta(n-2) + 4\delta(n-4)$

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3. (a) Solve the difference eguation 10

$$y(n)-\frac{1}{9}y(n-2)=x(n-1)$$

with $y(-1) = 0$, $y(-2) = 1$, $x(-1) = 0$ and $x(n) = 3\ u(n)$

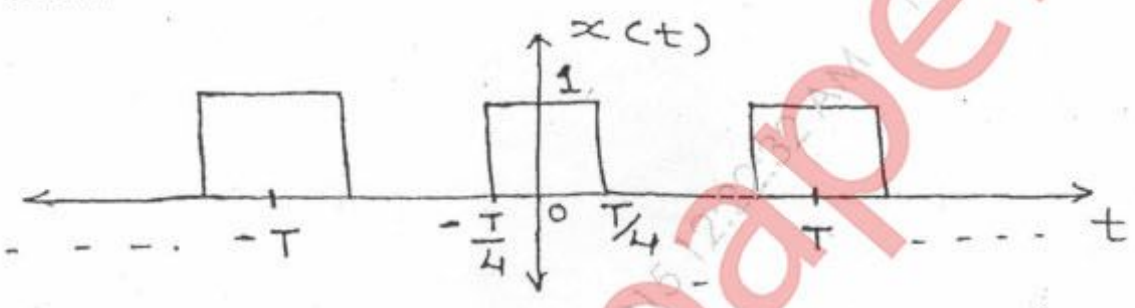
(b) Classify the following system for memory, linearity, causality, time variance and stability. 5

$y(n) = a\ x(n) - b\ x(n-1)$

(c) Find x(t) corresponding to FT 5

$$x(jw)=\frac{-jw}{(jw)^2+3jw+2}$$

4. (a) Determine complex exponential fourier series for the signal x(t) shown below 10



(b) Determine z-transform of following function 10

(i) $x(n)=\left(\frac{2}{3}\right)^n u(n+2)$

(ii) $x(n)=n\left(\frac{5}{8}\right)^n u(n)$

(iii) $x(n) = (0.6)^n\ u(n) * (0.9)^n\ u(n)$

5. (a) Find laplace transform of $x(t) = te^{-3t}\ u(t)$. Prove the property used. 5

(b) Find fourier transform of SINC function. 5

(c) Find the inverse laplace transform of 10

$$x(s)=\frac{-3}{(s+2)\ (s-1)}$$

If the ROC is

(i) $-2 < Re(s) < 1$

(ii) $Re(s) > 1$

(iii) $Re(s) < -2$

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6. (a) If $x(t) \leftrightarrow x(w)$ is fourier transform pair then prove that $x(t) \leftrightarrow 2\pi\, x(-w)$ 5

(b) Find the initial and final values of the signal 5

$$x(z) = \frac{(z-3)z}{(z-1)\ (z-0.4)}$$

(c) Find inverse z-Transform of 10

$$x(z) = \frac{1-\frac{1}{2}z^{-1}}{1+\frac{3}{4}z^{-1}+\frac{1}{8}z^{-2}} \quad |z|>\frac{1}{2}$$
