Reg. No. : .....

Name : .....

Fourth Semester B.Tech. Degree Examination, May 2013
(2008 Scheme)
Branch : Electronics and Communication
08.403 : SIGNALS AND SYSTEMS (TA)

Time : 3 Hours Max. Marks : 100

Instruction : *Answer* ***all*** *questions from Part* ***A.***

PART – A

1. Determine whether the following system is static, time invariant, linear, causal and stable :

   $\frac{3dy(t)}{dt} + 5ty(t) = x(t)$

2. Show that product of two odd signals is even; whereas the product of an odd signal and an even signal is odd.

3. What is the output sequence of a LTI system with $h[n] = \{\underset{\uparrow}{1}, 2\}$ and $x[n] = \{\underset{\uparrow}{1}, 2, 3\}$?

4. Consider the following signal :

   $x(t) = \cos\left(\frac{1}{3}t + \frac{\pi}{6}\right) + \sin\left(\frac{2}{5}t + \frac{\pi}{3}\right)$. Determine the power of the signal using Parseval's theorem.

5. Prove the Parseval's theorem in the case of discrete time Fourier series.

6. Find the Fourier series coefficients for the following sequence :

   $x[n] = 2\cos 2.2\pi n + 4\sin 3.4\ \pi n$.

7. The frequency spectrum of a function is given by $X(j\omega) = \begin{cases} 1 & |\omega| < 2 \\ 0 & \text{otherwise} \end{cases}$. Find the function, x(t).

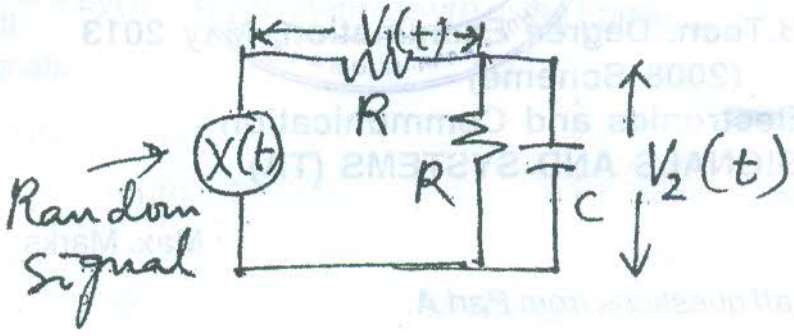
8. Determine the Laplace transform of the hyperbolic cosine and sine functions.

9. Solve the following difference equation $y[n] - 9y[n-1] + 20y[n-2] = 4x[n-1] + 2x[n-2]$

   The input is $x[n] = \left(\frac{1}{2}\right)^n u[n]$ and $y[-1] = 2$ & $y[-2] = 1$.

P.T.O.

10. The auto correlation of a random telegraph signal X(t) is $R_x(t) = e^{-2\lambda|t|}$ where λ is a constant. In figure shown below, determine the PSD of $V_1(t)$ and $V_2(t)$.



(4×10=40 Marks)

PART – B

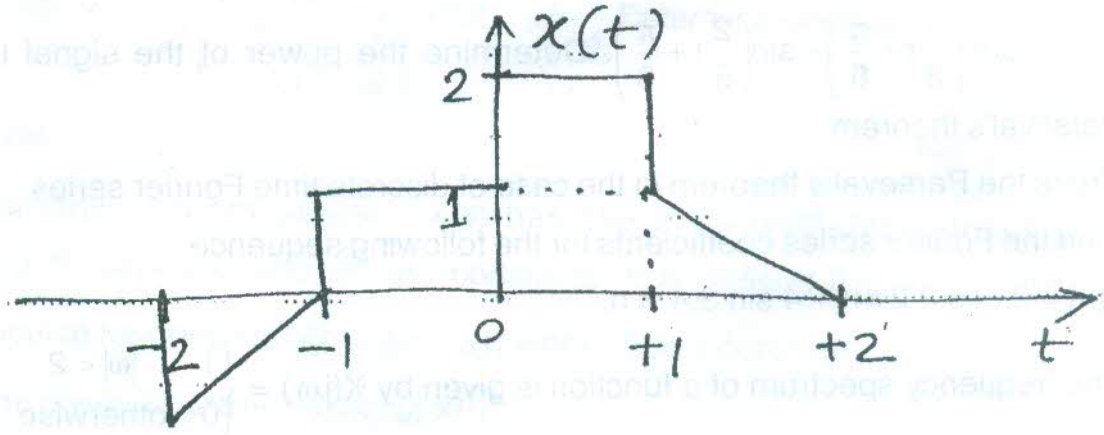
Answer **any two** questions from **each** Module. **(10×6=60 Marks)**

MODULE – I

11. a) A continuous time signal x(t) is shown in figure. Sketch and label the following :

i) $x(2-t)$

ii) $x(t)\left[\delta\left(t+\frac{3}{2}\right)-\delta\left(t-\frac{3}{2}\right)\right]$



b) Find whether the following signals are odd or even. Find the odd and even components.

i) $x(t) = t^4 + 4t^2 + 6$

ii) $x(t) = e^{j10t}$

iii) $x(t) = t^3 + 3t$ **10**

12. Find the energy and power of the following signal $x[n] = a^n u[n]$ for the following cases :

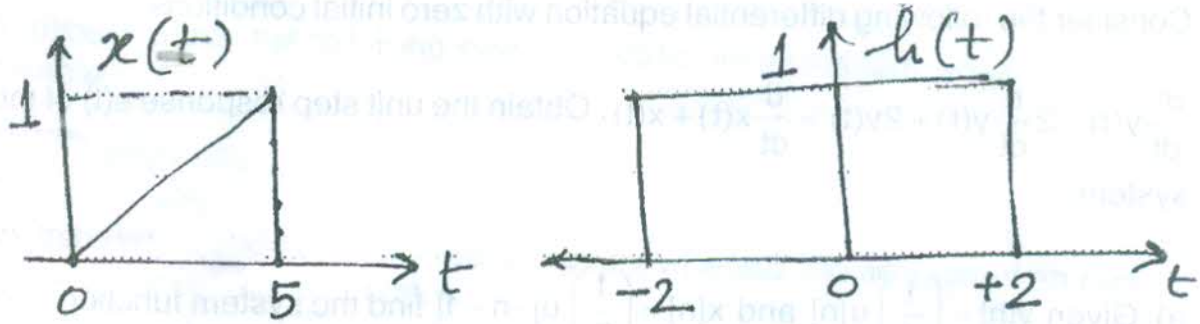
    a) $|a| < 1$

    b) $|a| = 1$

    c) $|a| > 1$ 10

13. Find the output response y(t) for the signals shown in figure below :

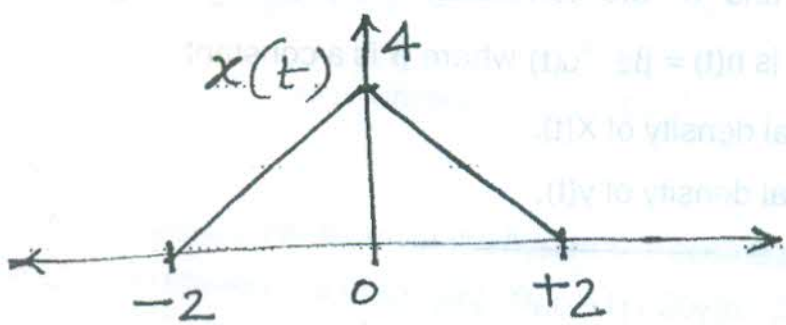
    where x(t) and h(t) represent the i/p and impulse respose of an LTI system. 10



MODULE – II

14. Determine the trigonometric Fourier series representation of a full wave rectified signal. 10

15. Consider the triangular pulse shown below. Find the Fourier transform and its amplitude spectrum. 10



16. A continuous linear time invariant system is described by the following differential equation.

$\frac{dy(t)}{dt} + 5y(t) = x(t)$. Determine y(t) using Fourier transform for the following input signals

a) $x(t) = e^{-2t}u(t)$

b) $x(t) = 10u(t)$ 10

MODULE – III

17. Consider the following differential equation with zero initial conditions

$\frac{d^2}{dt}y(t) + 2\frac{d}{dt}y(t) + 2y(t) = \frac{d}{dt}x(t) + x(t)$. Obtain the unit step response s(t) of the system. 10

18. a) Given $y[n] = \left(\frac{1}{4}\right)^n u[n]$ and $x[n] = \left(\frac{1}{2}\right)^n u[-n-1]$ find the system function and hence the impulse response, assuming that the system is LTI.

b) Given that $H(z) = \frac{(z-1)(z+2)}{\left(z-\frac{1}{2}\right)\left(z-\frac{3}{4}\right)}$, ROC : $|z| > \frac{3}{4}$ Determine whether the system is causal. 10

19. The stationary random process X(t) has the autocorrelation function $R_x(\tau) = \sigma^2 e^{-\mu|\tau|}$ where μ and σ^2 are constants. It is passed through a filter whose impulse response is $h(t) = \beta e^{-\beta t}u(t)$ where β is a constant.

a) Find the power spectral density of X(t).

b) Find the power spectral density of y(t). 10