(Pages : 3) **2011**

Reg. No. : ....

Name : ....

Fourth Semester B.Tech. Degree Examination, May 2014
08.403 : SIGNALS AND SYSTEMS (TA)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Plot the following continuous time signals
   a) $u(2-2t)$, where $u(t)$ is a unit step signal
   b) $3r(2t+1)$, where $r(t)$ is a unit ramp signal

2. Determine whether the following discrete time signals are periodic or non-periodic. If a signal is periodic, find its fundamental period.
   a) $\cos(\pi n/2)\cos(\pi n/4)$ b) $\cos(\pi n)+\cos(2n)$.

3. Evaluate the following integrals :
   a) $\int_{-\infty}^{\infty}\cos(t)\,\delta(\pi-t)dt$ $\int_{-4}^{4}\cos(\pi t)\,\delta(2t-6)dt$, where $\delta(t)$ is a continuous time unit impulse function.
   b) Find the Fourier series of the following signal. Also find the power using Fourier series coefficients.
   $x(t) = \cos^2 t$.

4. State sampling theorem for low-pass signals.

5. Find the continuous time Fourier transform of the signal $x(t) = e^{-at}u(t)$.

6. Find the inverse discrete time Fourier transform of
   $X(e^{j\Omega}) = 1+\cos(\Omega)+2\sin(2\Omega)$.

7. A causal and stable continuous time LTI system is described by the differential equation $\frac{d^2y(t)}{dt^2} - 3\frac{dy(t)}{dt} + 2y(t) = x(t) - \frac{dx(t)}{dt}$. Find the transfer function of the system.

P.T.O.

8. A discrete time LTI system is described by the System function

$H(z) = \dfrac{z^2}{z^2 - 3/4z + 1/8}$. Find the difference equation relating the input and output of the system.

9. Briefly explain strict sense stationary and wide sense stationary random processes.

10. Explain the properties of Power Spectral Density (PSD) of a stationary random process. **(10×4=40 Marks)**

PART – B

Answer **any two** questions from **each** Module.

Module – I

11. Classify the following continuous time signals into energy signal, power signal or neither, and find energy or power of the signals.

a) $e^{2t}\, u(-t)$ b) $e^{-(2+j)t}$ c) $e^{j(\pi/4t + \pi/2)}$ **10**

12. Determine whether each of the following discrete time systems is linear, shift invariant, causal stable, memory less and invertible.

a) $y[n] = nx[n]$. b) $y[n] = \sum_{k=-\infty}^{2n} x[k]$. **10**

13. A discrete time LSI system has impulse response $h[n] = \left(\frac{1}{3}\right)^n u[n]$. Find the output of the system to the input $x[n] = \left(\frac{1}{9}\right)^n u[n]$. **10**

Module – II

14. Determine the Fourier series representation for the continuous time signal $x(t) = \cos(4\pi t - 2) + 2\sin(5\pi t) - 10$. Plot its magnitude and phase spectra. **10**

15. State and prove any two properties of discrete time Fourier Transform. **10**

16. Find the Fourier transform of the following continuous time signals.

a) $e^{-2|t|}$ b) $\mathrm{sgn}(t)$. **10**

Module – III

17. Determine the natural and forced responses for the continuous time system described by the following differential equation with specified input and initial conditions.

$$\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + 5y(t) = \frac{dx(t)}{dt}.$$

$$y(0^+) = 2,\ y'(0^+) = 0 \quad x(t) = e^{-t}u(t).$$

10

18. Determine all possible discrete time signals having Z transform

$$X(z) = \frac{1}{1-6z^{-1}+8z^{-2}}.$$

10

19. Consider a random process X(t) defined by $X(t) = A\cos(2\pi f_c t)$, where the frequency f_c is constant and the amplitude A is a random variable uniformly distributed over the interval [0, 1]. Find the mean and autocorrelation functions of this random process. Is it a stationary random process ? 10