D 20622-A (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, OCTOBER 2011

EC 09 304 / PTEC 09 303 SIGNALS AND SYSTEMS

(2009 admissions)

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Find the energy of the signal $x(t) = e^{-2t}\, u(t)$.
2. What is meant by invertible system ?
3. What is frequency response ?
4. Define discrete Fourier-series representation for a periodic sequence.
5. What is the ROC of the z-transform of $x(n) = \left(\frac{1}{2}\right)^n u(n)$?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. Show that $x(t) * \delta(t-\tau) = x(t-\tau)$.
7. Plot $u(2t-5)$ and $u(½ - 3t)$.
8. Find the Fourier transform of $x(t) = 1, \quad |t| \le 1$
   $= 0, \quad |t| > 1.$
9. What is meant by aliasing ? Explain.
10. Derive the necessary and sufficient condition for the causality of an LTI system.
11. State prove time delay property of one sided z-transform.

(4 × 5 = 20 marks)

Part C

12. (a) (i) Determine whether the following signals are energy or power signals :

    (1) $x_1(t) = e^{-2t}u(t)$.

    (2) $x_2(t) = t\, u(t)$.

    (3) $x_3(t) = \sin(w_1 t) + \cos(w_2 t)$.

Turn over

(ii) Determine whether the following systems are time-invariant or time-varying :—

(1) $y_1(t) = x(t) \cos(100 \pi t)$.

(2) $y_2(t) = x(t + 10) + x^2(t)$.

Or

(b) Find the convolution of $x(t) = e^{-2t} u(t)$ with $h(t) = e^{-t} u(t)$.

13. (a) Find the Fourier transform of $x(t) = e^{-2t^2}$.

Or

(b) (i) Find the Fourier transform and spectral density of the signal :

$$\begin{aligned} x(t) &= 1, \quad -1 \le t \le 0 \\ &= -1, \quad 0 \le t \le 1 \\ &= 0, \quad \text{otherwise.} \end{aligned}$$

(6 marks)

(ii) State and prove correlation theorem of Fourier transform. (4 marks)

14. (a) The system is described by the differential equation $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t)$ with $y(0) = 3$ and $\left.\frac{dy(t)}{dt}\right|_{t=0} = -5$. Find the output for $x(t) = 2\,u(t)$.

Or

(b) (i) Consider a discrete time LSI system whose input $x(n)$ and output $y(n)$ are related by

$$y(n) = \sum_{k=-\infty}^{n} 2^{k-n} x(k+1).$$

Is the system causal and stable ?

(6 marks)

(ii) Explain how to determine the frequency response of system from poles and zeros.

(4 marks)

15. (a) Find inverse z-transform of $X(z) = \frac{z+2}{2z^2 - 7z + 3}$ for all possible ROCs.

Or

(b) Determine the response of the system described by the difference equation :

$$3y(n) - 4y(n-1) + y(n-2) = x(n)$$

with $y(-1) = 1$, $y(-2) = 2$

for the input $x(n) = \left(\frac{1}{2}\right)^n u(n)$.

(4 × 10 = 40 marks)