Code No. : 6124

FACULTY OF ENGINEERING
B.E. 2/4 (ECE) II Sem. (Main) Examination, June 2010
SIGNAL ANALYSIS AND TRANSFORM TECHNIQUES

Time : 3 Hours] [Max. Marks : 75

***Note** : Answer **all** questions from Part – A. Answer **any five** questions from Part – **B**.*

PART – A **(25 Marks)**

1. Determine whether the signal $x(t) = A \cos(\omega_0 t + \theta)$ is a energy signal, power signal or neither.

2. Find the orthogonality of the signals $\sin \omega t$ and $\sin 2\omega t$ over the time interval (O, T).

3. Obtain the complex exponential Fourier series representation for the signal $x(t) = \sin^2 t$.

4. Find the Fourier transform of the signal $x(t) = 1$.

5. State and prove Parseval's theorem for the Fourier transform.

6. Find the Laplace transform and the associated ROC for the signal $x(t) = e^{-2t}[u(t) - u(t-5)]$.

7. Find the inverse Laplace transform for $x(s) = \dfrac{2s+4}{s^2+4s+3}$, $-3 < \text{Re}(s) < -1$

8. Obtain the z-transform and the associated ROC for the sequence $x(n) = n\,a^n\,U(n)$.

9. Determine the initial and find values of x(n), given $x(z) = \dfrac{z}{2t^2 - 3z + 1}$, $|z| > 1$.

10. Obtain the convolution of the functions $f_1(t) = e^{-2t}$ and $f_2(t) = u(t)$.

Code No. : 6124

PART – B (50 Marks)

11. Consider the triangular wave x (t) shown in Fig. 1. Find

a) the complex exponential Fourier series of x (t), and

b) the trigonometric Fourier series of x (t).

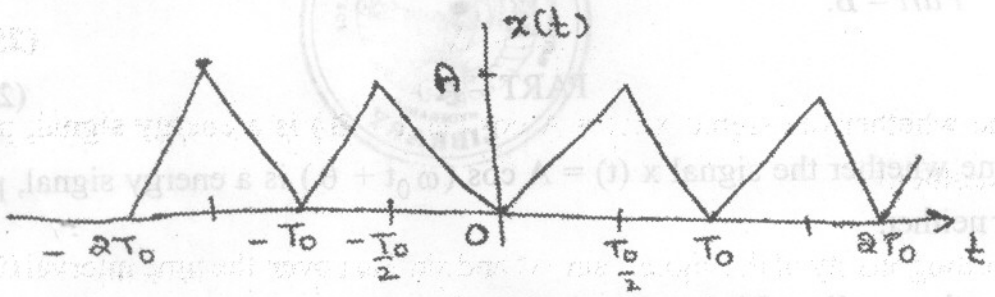

Fig. 1

12. a) Find the Fourier transform of the signum function, sgn (t) which is defined as

$$\text{Sgn}(t) = \begin{cases} 1 & t > 0 \\ -1 & t < 0 \end{cases}.$$

b) Using the time convolution theorem, find the inverse Fourier transform of

$$X(\omega) = \frac{1}{(a + j\omega)^2}.$$

13. a) Find the Laplace transform of

$$x(t) = \left(e^{-t}\cos 2t - 5e^{-2t}\right)u(t) + \frac{1}{2}e^{-2t}u(-t).$$

b) Find the inverse Laplace transform of

$$X(s) = \frac{s^2 + 2s + 5}{(s+3)(s+5)^2} \quad \text{Re}(s) > -3.$$

14. Consider a causal discrete-time system whose output y(n) and input x(n) are related by $y(n)-\frac{5}{6}y(n-1)+\frac{1}{6}y(n-2)=x(n)$.

    a) Find its system function H (t)

    b) Find its impulse response h (n).

15. a) State the properties of convolution.

    b) Obtain the output signal of a system whose input signal, $x(t)=e^{-t}u(t-1)$ and the impulse response, h (t) = 2u (t – 1).

16. a) Determine the z-transform of $x(n) = (\cos^2 \omega n)u(n)$.

    b) Using partial fraction expansion method obtain the inverse z-transform of

$$x(z) = \frac{6z^3+2z^2-z}{z^3-z^2-z+1}.$$

17. Write short notes on the following :

    a) Sampling theorem

    b) Fourier transform of periodic signals

    c) Autocorrelation and its properties.
