ANNA UNIVERSITY COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : MAY / JUNE 2010

REGULATIONS : 2007

FOURTH SEMESTER : ECE

070290013 - SIGNALS AND SYSTEMS

TIME : 3 Hours **Max.Marks : 100**

PART – A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

1. Verify whether $x(t) = A\,e^{-\alpha t}u(t)$ is a energy signal or not.
2. Check whether the signal $x(t) = 2\cos 3\pi t + 7\cos 9t$ is periodic or not.
3. Prove that for the causal LSI system the impulse response h[n] = 0, for n < 0
4. Obtain the even and odd components of $x(t) = e^{-2t}u(t)$
5. Find Fourier transform of $x(t) = \exp(-3|t-2|)$
6. Write Dirichlet conditions for the time Fourier transform.
7. State and prove time convolution property of the Laplace transform
8. Determine the Laplace transform of $x(t) = e^{-at}\sin(\omega t)\,u(t)$
9. How periodic continuous signals are Fourier transformed?
10. A signal x(t) is ideally sampled by a train of impulses occurring every T_s sec. Considering the signal x(t) to be band limited to f_m Hz and also that $T_s << 1/f_m$. Sketch the sampled signal's spectrum.
11. State Nyquest sampling theorem.
12. What is aliasing effect?
13. Use Parseval's theorem to evaluate $X = \int_{-\infty}^{\infty} \frac{6}{|jw+3|^2} dw$
14. Find Z transform of $x[n] = a^{|n|}, a > 0$
15. The z- transform of a sequence x(n) is X(z), what is the z-transform of nx(n)?

16. Determine the inverse Z transform $X(z) = \frac{3z^{-2}}{\left[1-\frac{1}{4}z^{-1}\right]^2}, |z| > \frac{1}{4}$
17. 33. What are the different methods of evaluating inverse z-transform?
18. The unit sample response of an FIR filter is $h[n] = \alpha^n\{u[n]-u[n-2]\}$, draw direct form realization of this system.
19. The z-transform of a sequence x[n] is x(Z) = [z+2 z^{-2} + z^{-3}] / [1-3z^{-4} + z^{-5}] If the region of Convergence includes the unit circle find the DTFT of x[n] at $\omega=\pi$
20. Draw the block-diagram representation the following system

$$y[n]-\frac{1}{2}y[n-1] = x[n]+\frac{1}{2}x[n-1]$$

PART – B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21. a For the, following signals (i) determine analytically which are periodic (if periodic, give the period) and (ii) sketch the signals. 6

(i) x(t) = 4 cos(5πt)

(ii) x(t) = 4 cos(5πt-π/4)

b A trapezoidal pulse x(t) is defined by 6

$$x(t) = \begin{cases} 5-t, 4 \le t \le 5 \\ 1, -4 \le t \le 4 \\ t+5, -5 \le t \le -4 \end{cases}$$

Determine total energy of x(t) and sketch x(2t-3)

22. a Obtain the Fourier series expansion of a half wave sine wave. 6

b Find the inverse Laplace transform of , $\frac{3s^2+8s-23}{(s+3)(s^2+2s+10)}$ 6

23. State and prove sampling theorem.

24. a State and prove any two properties of continuous time Fourier transform 6

b Using the properties of continuous time Fourier transform, determine the time domain signal x(t), if the frequency domain signal $X(j\omega)=j\frac{d}{d\omega}\left\{\frac{e^{j2\omega}}{1+i\omega/3}\right\}$ 6

25. a Find the DTFT of $x[n]=a^{-n}u[-n-1]$ 6

b Use Parsavel's theorem for Fourier series to find the average power in the signal $x(t)=3\sin^2(2500\pi t)\cos(2000\pi t)$ 6

26. An LTI system is descried by the differential equation $\frac{d^2y(t)}{dt^2}+3\frac{dy(t)}{dt}+2y(t)=x(t)$. Using Lapalce Transform, find total response if input is $x(t)=e^{-2t}$ and the initial conditions are $y(0)=\frac{25}{18}$ and $\dot{y}(0)=-\frac{2}{3}$

27. For a DT system when the input x[n] = u[n], the out put y[n] = $(1/2)^{n-1}$ u[n-1].

Find H(Z) and obtain its pole zero diagram and show that the difference equation is y[n] = x[n-1]-x[n-2]+1/2 y[n-1] ,

28. Consider the causal LTI system characterized by the different equation

$$y[n]-\frac{3}{4}y[n-1]+\frac{1}{8}y[n-2]=2x[n]$$

i. Determine the system function H[Z] (3)

ii. Find output of the system when input $x[n]=\left(\frac{1}{4}\right)^n u[n]$ (4)

iii. Is the system stable? (2)

iv. Draw block diagram realization of the system. (3)

*******THE END*******