ANNA UNIVERSITY COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : DECEMBER 2009

REGULATIONS - 2007

FOURTH SEMESTER – ELECTRONICS & COMMUNICATION ENGINEERING

070290013 - SIGNALS AND SYSTEMS

TIME : 3 Hours Max.Marks : 100

PART – A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

1. Find average power of the signal, $x[n] = 2^n u[n]$.
2. If the discrete - time signal $x[n] = \{-1, 0, 7, 2, 5, -6, -4, 3\}$, then find $y[n] = x[2n-3]$
3. Check whether the system defined by h[n]= [$3(0.5)^n$ - $4(0.25)^n$] u[n] is time-invariant.
4. Write the relationship between unit step, unit impulse & unit ramp signals.
5. Prove that for the causal LSI system the impulse response h[n] = 0, for n < 0
6. Determine even and parts of the signal, $x[n] = \left(\frac{1}{2}\right)^n u[n]$
7. Determine whether the following signal is periodic, if periodic determine fundamental period, $x[n] = e^{j7\pi n}$
8. Determine the Nyquist rate for the signal $x(t) = 1 + \cos(2000\pi t) + \sin(4000\pi t)$
9. What is aliasing? How will you avoid it?
10. State Parseval's theorem.
11. Find Fourier transform of $x(t) = \exp(-3|t-2|)$

12. A signal x(t) is ideally sampled by a train of impulses occurring every Ts sec. Considering the signal x(t) to be band limited to fm Hz and also that Ts << 1/fm. Sketch the sampled signal's spectrum.
13. Write the equations for forward and inverse Laplace Transform
14. Find Laplace transform of $x(t) = \exp(|t|)$
15. Determine the inverse Z transform $X(z) = \frac{4z^{-2}}{\left[1 - \frac{1}{6}z^{-1}\right]^2}, |z| > \frac{1}{6}$
16. Find Z transform of $x[n] = a^{|n|}, a > 0$
17. Determine DTFT of x[n] = a^n u[n]
18. Obtain the magnitude response of a DT system defined by the difference equation y[n] =x[n] - 1/3 x[n-1]
19. Compare Z transformation with DTFT
20. Find inverse z-transform of X(z)= log(1+az^{-1}) ROC |z| > a

PART – B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21. Determine whether the following systems are (1) memory- less (2) time-invariant (3) linear (4) causal and (5) stable
    (a) y(t) = x(t/2)
    (b) y(n) = x(-n)
    (c) y(t) = $x(t^2)$
    (d) y(n) = n x(n)

22 a) Briefly explain about the following basic signals, unit step unit ramp, unit impulse and exponential. Also derive the relationships between the first 3 basic signals mentioned above. 6

b) With the help of mathematical equations, briefly explain about classification of CT signals namely periodic and aperiodic, energy and power, even and odd. 6

23. For a discrete time system described by the difference equation y[n] = 3x[n]-4x [n-1] +3.5y [n-1]-1.5y [n-2], determine its frequency response and response to an input x[n] = 2^{-n} u[n]. Plot the magnitude response of the system.

24. State and prove sampling theorem

25. a) State and prove convolution in time and convolution in frequency properties of Laplace transform 6

b) A system has the transfer function $H(s)=\frac{2}{s+3}+\frac{1}{s-2}$. Find the impulse response assuming the system is stable, and the system is causal 6

26. a) State and prove any 2 properties of the DTFT 6

b) State and prove any 2 properties of DFT 6

27. Determine the inverse Z transform of $X(Z)=\log(1-2Z)$, $|Z|<\frac{1}{2}$ by using the power series $\log(1-x)=-\sum_{i=1}^{\infty}\frac{x^i}{i}$, $|x|<1$ and by first differentiating X(Z) and then using this to recover x[n]

28. The input to a causal linear time invariant system is $x[n]=u[-n-1]+\left(\frac{1}{2}\right)^n u[n]$, the Z transform of the output of the system is $Y(Z)=\frac{-\frac{1}{2}Z^{-1}}{\left(1-\frac{1}{2}Z^{-1}\right)\left(1+Z^{-1}\right)}$. Determine H(Z), the Z transform of the impulse response and also determine the output y[n].

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