ANNA UNIVERSITY OF TECHNOLOGY, COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : NOV / DEC 2010

REGULATIONS : 2008

THIRD SEMESTER - ECE

080290015 - SIGNALS AND SYSTEMS

TIME: 3 Hours　　　　Max.Marks: 100

PART – A

(20 x 2 = 40 Marks)

ANSWER ALL QUESTIONS

1. Represent the unit step sequence u[n] in terms of linear combination of weighted shifted impulse functions
2. Find the fundamental period of the signal $x(t)=\sin\left(\frac{7\pi}{3}t\right)$
3. Define Energy and Power signal
4. Is the system $\frac{d^2y(t)}{dt^2}+4t\frac{dy(t)}{dt}+5y(t)=x(t)$ linear and time invariant?
5. Find $F^{-1}[2\pi\delta(\omega)]$?
6. What is Region of Convergence?
7. Find the Laplace transform of $u(t+2)$
8. State and prove the time scaling property of Fourier transform
9. What is the necessary and sufficient condition on the impulse response for stability?
10. Define Transfer function.
11. Define state of a system.
12. Plot the pole zero diagram for the transfer function $\frac{s+2}{s^2+2s+2}$
13. State Sampling theorem.

14. Write any four properties of Region of convergence of the Z transform.
15. What is the overall impulse response h(n) when two systems with impulse responses $h_1(n)$ & $h_2(n)$ are in series?
16. What are the different methods of evaluating inverse Z transform?
17. Find the convolution of the following sequence

    $$x_1(n)=\{2,-1,1,3\}\ \&\ x_2(n)=\{0,3,4,2\}$$

18. Write the Discrete time Fourier transform pairs
19. Find $x(\infty)$ when $X(z)=\frac{z+2}{(z=0.8)^2}$
20. Find the transfer function $H(2)$ of the system

    $$y[n]-0.5y[n-1]=x[n]+0.3x[n-1]$$

PART – B

(5 × 12 = 60 Marks)

ANSWER ANY FIVE QUESTIONS

21. Find the state variable matrices A,B,C and D for the equation

    $$y(n)-3y(n-1)-2y(n-2)=x(n)+5x(n-1)+6x(n-2)$$

22. Check linearity, time invariance, causality and memory status of the systems

    (i) $y(n)=x(n)x(n-1)$　　(ii) $y(t)=10x(t)+5$

    (iii) y[n] = n x[n]　　(iv) y(t) = x(-t)

23. Find the Fourier series representation of the signal

$$x(t) = \begin{cases} t+2 & for\ -2 \le t \le -1 \\ 1 & for\ -1 \le t \le 1 \\ 2-t & for\ 1 \le t \le 2 \\ 0 & for\ 2 \le t \le 3 \end{cases}$$

24. The input and output of a causal LTI system are related by the differential equation $\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} = 8y(t) = 2x(t)$. What is the response of the system if $x(t) = te^{-2t}u(t)$

25. (a) Find the fundamental period of the following signals (8)

(i) $x(n) = \sin 2\pi n + \sin 6\pi n$

(ii) $x(n) = 2\cos\left(\frac{\pi n}{4}\right) + \sin\left(\frac{\pi n}{8}\right) - 2\cos\left(\frac{\pi n}{2} + \frac{\pi}{6}\right)$

(iii) $x(t) = \sin\left(\frac{\pi t}{3}\right)$

(iv) $x(n) = \sin 7n$

(b) State and prove any two properties of DTFT. (4)

26. (a) Determine the inverse Z transform of $X(z) = \frac{z+1}{z^2 - 3z + 2}$ when x(n) is causal (6)

(b) Determine the inverse Z transform of

$$X(z) = \frac{0.25z^{-1}}{(1-0.5z^{-1})(1-0.25z^{-1})}, \quad ROC: |z| > 0.5$$ (6)

27. Find the solution to the following linear constant coefficient difference equation

$$y(n) - \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = \left(\frac{1}{4}\right)^n \ for\ n \ge 0$$ with initial conditions

y(-1)=4 and y(-2)=10

28. Realize the following discrete time system function in cascade and parallel form

$$H(z) = \frac{1}{(1+\frac{1}{2}z^{-1})(1-\frac{1}{4}z^{-1})}$$

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