MODEL QUESTION PAPER

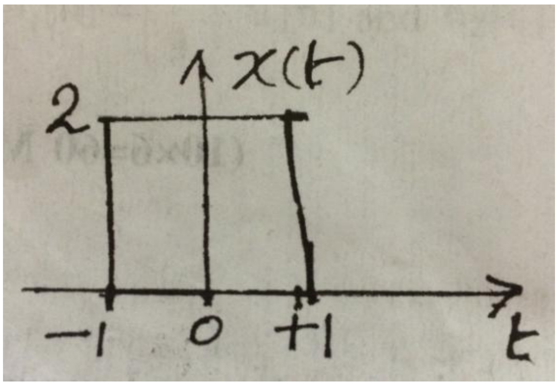
SIXTH SEMESTER BTECH COMPUTER SCIENCE & ENGINEERING DEGREE EXAMINATION

SIGNALS AND SYSTEMS (13.606)

PART A

Answer **all** questions from Part A. Each question carries 4 marks.

1. Obtain x(2t+3) for the signal x(t) shown below:



2. Find the z-transform and ROC for sequences:
   a) a^{n+1} u[n+1]
   b) a^{n-1} u[n-1]
3. Find the impulse response of a causal and stable LTI system described by : y(n)-(3/4)y(n-1)+(1/8)y(n-2)=2 x(n).
4. Find the Nyquist rate of the signals.
   x(t)= 1+cos(200 π t)+sin(400 πt) and x(t)= $\frac{(\sin\ 400\pi t)}{\pi t}$
5. State and prove time-shift property of DFT.

(5*4=20 marks)

PART B

Answer **any one** question from each module. Each question carries 20 marks.

MODULE I

6. Check whether the following are linear, static, Time Invariant , Causal and stable
   a) y(t)=x(t)cos ?t
   b) y(n)=x(-n)
   c) y(n)=log[x(n)]
   d) y(n)=x(n)+n (4x5 = 20)

OR

7. a) State and explain sampling theorem with an example (6)

b) Illustrate up-sampling with example. (5)

c) Discuss various mathematical operations on independent variables (5)

d) Plot u(n+3)-u(n-3) , ⍰(2n) & e^{t} u(-t) (4)

MODULE II

8. a) Obtain the Laplace transforms of the following:

i) x(t)= tu(t)

ii) x(t)=cos bt u(t) (2x4=8)

b) Solve the following differential equations

i) $4(d^2y/dt^2) + (dy/dt) + y = 2$

ii) $(d^2y/dt^2) + 3(dy/dt) + 2y = 4$ (2x6=12)

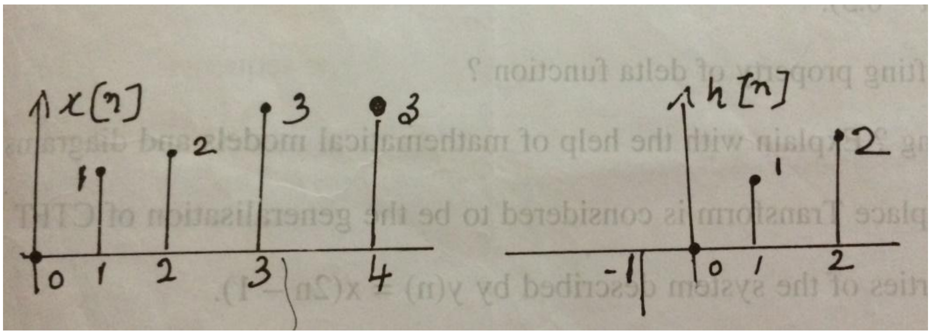
OR

9. a)Find the Fourier transform of

i) x(t)= t^2u(t) u(1-t) and

ii) x(t)= t exp(-⍰t) u(t) , ⍰>0 (2x6=12)

b) Numerically evaluate the convolution of following signals



(8)

MODULE III

10. a) Determine the zero input and zero state response by using unilateral Z-transform of the following :

y(n)-(1/2) y(n-1)= x(n) - (1/2) x(n-1)

x(n)=u(n)

y(-1)=0 (10)

b) Given y(n) = $(1/4)^n$ u(n) and x(n)= $(1/2)^n$ u(-n-1) find the system function and hence the impulse response, assuming that the system is LTI (10)

OR

11. a) Explain the duality between the discrete time Fourier transform and continuous time Fourier series (6)

b) Given that H (z) = $\frac{(z-1)(z+2)}{(z-\frac{1}{2})(z-\frac{3}{4})}$, ROC: |z|>3/4. Determine whether the system is causal

(14)

MODULE IV

12 a) Consider the length-10 sequence defined for 0 ≤ n ≤ 9:

x[n] = {1,2,3,4,5,6,7,8,9,10}, with a 10-point DFT given by X[k], 0 ≤ k ≤ 9.

Evaluate the following functions of X[k] without computing the DFT:

i) X[0] ii) X[5] iii) $\sum_{k=0}^{9} X[k]$ iv) $\sum_{k=0}^{9} |X[k]|^2$ (10)

b) Draw the DIT-FFT flow diagram for an 8 point FFT and obtain the FFT of the sequence x(n) = [1, 2, 3, 4, 4, 3, 2, 1]. (10)

OR

13 a) A discrete time system has the system function

$$H(z) = 3 + \frac{4z}{z - 1/2} - \frac{2}{z - 1/4}.$$

Draw the block diagram of the Direct Form Canonic realization for this system. (10)

b) Realise the system function H(Z) = $\frac{16(Z+1)Z^2}{(4Z^2-2Z+1)(4Z+3)}$ using i) Direct form II and ii) Cascade form (10)