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GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, December – 2020

(Fifth Semester)

BECOE 5050 – Introduction to Digital Signal Processing

(CSE & IT)

Time: 2 hrs Maximum; 50 Marks

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) **(1 x 10 = 10 Marks)**

Q.1. Answer ***ALL*** questions [CO#] [PO#]

a. The energy of a signal x[n] = $(a)^n$ u[n] is 9/8 units, the value of a is CO1 PO1

(i) 1/2 (ii) 1/3

(iii) 1/4 (iv) 3/4

b. If the unit step response of a network is $(1-e^{-at})$, then its unit impulse response is CO1 PO2

(i) $a\ e^{-at}$ (ii) $a^{-1}\ e^{-at}$

(iii) $(1-a^{-1})e^{-at}$ (iv) $(1-a)\ e^{-at}$

c. A system is defined by its impulse response $h(n) = 2^n u(n-2)$. The system is CO2 PO2

(i) stable and causal (ii) causal but not stable

(iii) stable and but not causal (iv) unstable and non-causal

d. The input and output of a discrete time system are denoted by x[n] and y[n]. Which of the following represents causal system? CO2 PO1

(i) $\delta[n-1] + \delta[n-2]$ (ii) $\delta[n-4]$

(iii) $\delta[n-3]$ (iv) $\delta[n-1]\,\delta[n-2]$

e. Two discrete time system with impulse response $h_1[n] = \delta[n-1]$ and $h_2[n] = \delta[n-2]$ are connected in cascade. The overall impulse response of the cascaded system is CO3 PO1

(i) y[n] = x[$n-1$] +x[n+2] (ii) y[n] =[n-3]x[n+1]

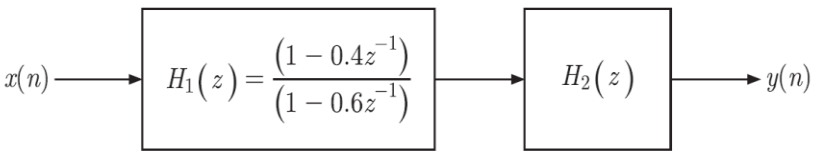
(iii) y[n] =[n+4]x[n-1] (iv) y[n] =[n+5]x[n+5]

f. A discrete time LTI system has an impulse response h[n] with h[0] = 1, h[1] = -1, h[2] = 2, and zero otherwise. The system is given an input sequence x[n] with x[0] = x[2] = 1, and zero otherwise. The number of nonzero samples in the output sequence y[n], and the value of y[2] are respectively CO3 PO2

(i) 5, 2 (ii) 6, 2

(iii) 6, 1 (iv) 5, 3

g. Two systems $H_1(z)$ and $H_2(z)$ are connected in cascade as shown below. The overall output y(n) is the same as the input x(n) with a one unit delay. The transfer function of the second system $H_2(z)$ is CO3 PO2



(i) $\frac{\mathbf{1 - 0.6z^{-1}}}{z^{-1}(1-0.4z^{-1})}$ (ii) $\frac{\mathbf{z^{-1}(1 - 0.6z^{-1})}}{(1-0.4z^{-1})}$

(iii) $\frac{\mathbf{z^{-1}(1 - 0.4z^{-1})}}{(1-0.6z^{-1})}$ (iv) $\frac{\mathbf{1 - 0.4z^{-1}}}{z^{-1}(1-0.6z^{-1})}$

h. The Z-transform of (n-1)x(n-1) CO4 PO1

(i) –(z-1)dX(z)/dz (ii) –zdX(z)/dx

(iii) –dX(z)/dz (iv) -X(z)/z

i. The ROC of *z* -transform of the discrete time sequence CO4 PO1

$\mathbf{x(n) = \left(\frac{1}{3}\right)^n u(n) - \left(\frac{1}{2}\right)^n u(-n-1)}$ **is**

(iv) $|\mathbf{z}| < \frac{\mathbf{1}}{\mathbf{3}}$ (v) $|\mathbf{z}| > \frac{\mathbf{1}}{\mathbf{2}}$

(vi) $\frac{\mathbf{1}}{\mathbf{3}} < |\mathbf{z}| < \frac{\mathbf{1}}{\mathbf{2}}$ (iv) $2 < |\mathbf{z}| < 3$

j. Consider the z-transform $X(z) = 5z^2 + 4z^{-1} + 3; 0 < |z| < \infty$. The inverse z-transform x[n] is CO4 PO2

(i) 5 δ[n+2] + 3 δ[n] + 4 δ[n-1] (ii) 5 δ[n-2] + 3 δ[n] + 4 δ[n+1]

(iii) 5 u[n-2] +3 u[n] +4 u[n+1] (iv) 5 u[n+2] + 3 u[n] + 4 u[n-1]

PART – B: (Short Answer Questions) (2 x 5 = 10 Marks)

Q.2. Answer ***ALL*** questions [CO#] [PO#]

a. Determine the energy and power of the signal x(t) = t u(t) CO1 PO1

c. Identify the Nyquist sampling rate for x(t) = 0.5 sin 50πt + 0.25 sin 25πt CO1 PO2

e. Define Static and Dynamic systems CO2 PO1

g. Find the convolution of the two sequences x(n) = {2, 2, 2, 2} and h(n) = {1, 1} CO3 PO2

h. Determine the range of 'a' for which the LTI system with impulse response $h(n) = a^n u(n)$ is stable. CO4 PO2

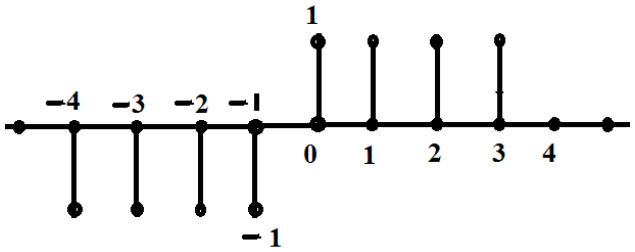
PART – C: (Long Answer Questions) (6 x5 = 30 Marks)

Answer ***ALL*** questions Marks [CO#] [PO#]

3. Check whether the following signals are periodic, if periodic, give the period (6) CO1 PO1

(1) x(t) = cos(4t)+2sin(8t) (2) x(t) = 3cos(4t)+sin(πt)

4. Determine and sketch the even and odd parts of the signals shown in figure. (6) CO1 PO1



5.	Give a broad classification of system and their details in brief	(6)	CO2	PO1
6.	Obtain the Direct Form-II, Cascade and Parallel realization of the system described by $y(n) = 3/4\ y(n-1) - 1/8\ y(n-2) + x(n) + 1/3\ x(n-1)$	(6)	CO2	PO1
7.	Determine the impulse response for the cascade of two LTI system having impulse response $h_1(n) = (1/2)^n\ u(n)$ and $h_2(n) = (1/4)^n\ u(n)$	(6)	CO3	PO2
8.	Determine the convolution of the signals x[n] = {2, -1, 3, 2} and h[n] = {1, -1, 1, 1}	(6)	CO3	PO2
9.	A linear time invariant (LTI) system is characterized by the system function $H(z) = \frac{3-4z^{-1}}{1-3.5z^{-1}+1.5z^{-2}}$ Specify the ROC of H(z) and determine h(n) for the following conditions: (i) The system is stable (or) ROC: $0.5 < \|z\| < 3$ (ii) The system is causal (or) ROC: $\|z\| > 3$ (iii) The system is anti-causal (or) ROC: $\|z\| < 0.5$	(6)	CO4	PO1
10.	A causal LTI system is described by y[n] -5/6 y[n-1] + 1/6 y[n-2] = x[n] where x[n] is the input to the system, h[n] is the impulse response of the system.Find system function H(z)	(6)	CO4	PO1

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