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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

October 2023 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: ES CLUSTER (EEE/ECE/EIE/ETE/MD) **Duration: 3 hrs.**
Course Code: 19ES4CCSAS **Max Marks: 100**
Course: SIGNALS AND SYSTEMS

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Determine whether each of the following signal is periodic. If periodic determine fundamental period. **06**

$i) x(t) = \cos t + \sin\sqrt{2}t$

$ii) x[n] = e^{j(\frac{2\pi}{3})n} + e^{j(\frac{3\pi}{4})n}$

b) Determine whether the following signal are energy or power signal **06**

$i) x(t) = tu(t)$

$ii) x[n] = 2e^{j3n}$

c) Find and sketch even and odd component of the following signal **08**

$i) x(n) = e^{-\left(\frac{n}{4}\right)}u[n]$

$ii) x[t] = t \quad 0 \le t \le 1$

$= 2 - t \quad 1 \le t \le 2$

OR

2 a) A trapezoidal pulse x(t) is defined by **06**

$x(t) = 5 - t \quad 4 \le t \le 5$

$= 1 \quad -4 \le t \le 4$

$= t + 5 \quad -5 \le t \le -4$

$= 0 \quad otherwise$

Is applied to a differentiator having input and output relationship y(t)=dx(t)/dt. Sketch the signal x(t), y(t) and . Find the energy of the signal y(t)

b) Sketch the waveforms **06**

$i) x(t) = u(t) - u(t-3)$

$ii) x(t) = r(t+1) - r(t) + r(t-2)$

Where u(t) and r(t) are step and ramp signals respectively.

c) Consider a discrete time signal x[n]= { 1, 2, -3, -2] , where amplitude of the signal at n=0 is 2. Express the signal in terms of unit impulse sequence and unit step sequence. **08**

UNIT - II

3 a) For the following system, determine whether the system is Linear ,time invariant ,Memoryless , causal , stable **05**

$$i) y[n] = g[n]x[n]$$

$$ii) y(t) = \cos(x(t))$$

b) Define invertible system? Determine whether the following system is invertible **05**

$$i) y(t) = 2x(t)$$

$$ii) y[n] = nx[n]$$

c) Evaluate the natural response for the system defined by the following differential equation. $\mathbf{3}\frac{\boldsymbol{dy(t)}}{\boldsymbol{dt}} + 10\boldsymbol{y(t)} = 2\boldsymbol{x(t)}$ **;** y(0)=3 **06**

d) Represent the following system in Direct form II **04**

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

UNIT - III

4 a) **06**

A LTI System is characterized by : $h[n] = \left(\frac{3}{4}\right)^n u[n]$

Determine the output of the system at time n=5, n=10, when input is x[n]=u[n]

b) Find the convolution of x(t)*h(t) if **06**

$$x(t) = e^{-3t}\{u(t) - u(t-2)\}$$

$$h(t) = e^{-t}u(t)$$

c) Impulse response of a system is given by **08**

$$h(t) = \frac{1}{RC}e^{-\frac{t}{RC}}u(t)$$

Find an expression for the frequency response. Plot the magnitude and phase response.

OR

5 a) For each of the impulse response listed below. Determine whether the system is memoryless, causal, and stable **06**

$$i) h(t) = e^{-2|t|}$$

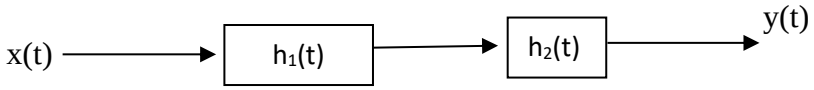
$$ii) h[n] = 2u[n] - 2u[n-1]$$

b) The system shown in figure below is formed by connecting two system in cascade. The impulse response of the system are given by **06**

$$i) h_1(t) = e^{-2t}u(t) \quad ii) h_2(t) = 2e^{-t}u(t)$$

i) Find the impulse response h(t) of the overall system

Determine if the overall system is BIBO stable



c) Find the impulse response of the system where output is given by **08**

$y[n] = x[n] + e^{\alpha}y[n-1]$ and y[n]=0 for n<0. Also find the step response

UNIT - IV

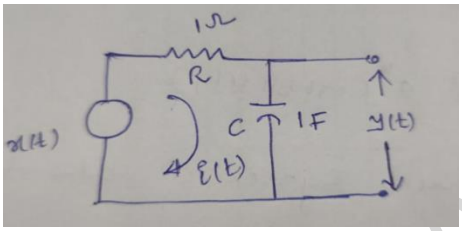
6 a) Evaluate the DTFS representation for the signal $x[n] = \cos\frac{\pi}{3}n$ **06**

Sketch magnitude and phase spectrum

b) Using partial fraction expansion, determine inverse fourier transfor of **06**

$$X(jw) = \frac{5j\omega + 12}{(j\omega)^2 + 5j\omega + 6}$$

c) For the network shown, find the response of the system when the input is impulse signal $\delta(t)$ **08**



UNIT - V

7 a) Find the z-transform for the following sequence. Locate ROC **06**

$i) x[n] = 1 \quad 0 \le n \le N-1$

$= 0 \quad elsewhere$

$x[n] = a^n \cos\omega_0 n u[n]$

b) A stable and causal system is described by the difference equation **06**

$$y[n] + \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = -2x[n] + \frac{5}{4}x[n-1]$$

Find the system impulse response

c) Solve the following difference equation for the given initial condition and input $y[n] - \frac{1}{9}y[n-2] = x[n-1]$ **08**

With y(-1)=0, y(-2)=1 and x[n]=3u[n]

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