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

Autonomous Institute Affiliated to VTU

August 2023 Semester End Make-Up Examinations

Programme: B.E. **Semester: III**
Branch: Electronics and Communication Engineering **Duration: 3 hrs.**
Course Code: 22EC3PCSAS **Max Marks: 100**
Course: Signals and Systems **Date: 10.08.2023**

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

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) Determine whether the following signals are Periodic or not ? If periodic determine fundamental period **06**

i) $x[n] = \cos(0.01\pi n)$

ii) $x[n] = \cos\left(\frac{n}{8}\right)\cos\left(\frac{n\pi}{8}\right)$

iii) $x[n] = e^{j\frac{\pi}{4}n}$

b) Determine whether each of the following signal as energy signal or power signal or neither of these two **06**

i) $x(t) = e^{-at}u(t)$

ii) $x[n] = (-0.5)^n u(n)$

iii) $x[n'] = 2e^{i3n}$

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

i) $x[n] = e^{-(n/4)}u(n)$

ii) $x(t) = t \quad 0 \le t \le 1$

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

UNIT - II

2 a) For the following system, determine whether the system is a) linear b) time-invariant c) Memoryless d) causal e) Stable **10**

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

ii) $y(t) = e^{x(t)}$

iii) $y[n] = \log_{10}(|x(n)|)$

iv) $y(t) = x(t)\cos\omega t$

b) Are the following systems invertible ? If not explain why? If invertible find the inverse system **04**

a) $y(n) = x^2(n)$

b) $y(n) = x(n) + 2x(n-1)$

c) Consider three system with the following input output relationships **06**
system 1; y(n)=x(-n)
System 2: y(n)=ax(n-1) + bx(n) + cx(n+1)
System 3: y(n)=x(-n)
Where a, b, c are real constants. Suppose these systems are connected in series as shown in figure 2c below. Find the input output relationship for the overall cascade system. Is this system is linear ? Time invariant ?

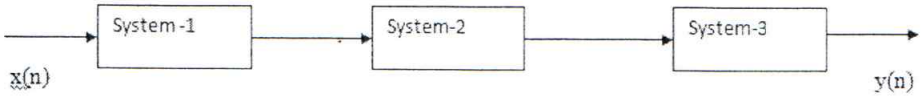

Figure 2c

UNIT - III

3 a) Consider an LTI System with input x[n] and unit impulse response h[n] specified as follows. Compute the output signal y[n]. Plot the output signal. **08**

$x[n] = 2^n u[-n]$

$h[n] = u[n]$

b) The system formed by connecting two sub systems in cascade. The impulse response of the each system is given by **06**

$h_1(t) = e^{-2t} u(t)$

$h_2(t) = 2e^{-t} u(t)$

i) Find the impulse response h(t) of the overall system
ii) Determine if the overall system is BIBO stable

c) For each of the impulse response listed below, determine whether system is memoryless , causal and stable **06**

$h_1(t) = e^{-2|t|}$

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

OR

4 a) For the differential equation given below find the natural response, forced response and total Response **08**

$$\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 4y(t) = 2e^{-2t}u(t)$$

$$y(0) = 0 \qquad y'(0) = 1$$

b) Determine the forced response for the following system **08**

$$y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + x(n-1)$$

for the input signal $x(n) = \left(\frac{1}{8}\right)^n u(n)$. Assume zero initial conditions.

c) Represent the following differential equations in Direct Form-I and Direct form –II **04**

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$$

UNIT - IV

5 a) Evaluate the DTFS representation of the signal **10**

$$x[n]=\sin\left(\frac{4\pi n}{21}\right)+\cos\left(\frac{10\pi n}{21}\right)+1$$

Sketch the magnitude and phase spectra

b) State Convolution and Modulation properties of DTFS. **04**

c) Find x[n] for X(k) given below **06**

$$X(k)=\cos\left(\frac{6\pi k}{17}\right)$$

OR

6 a) Find the DTFT of the signal **08**

$$x[n]=\left(\frac{1}{2}\right)^n u(n-4)$$

Sketch magnitude and phase spectra

b) Using partial fraction expansion determine the inverse DTFT for the signal **06**

$$X(e^{j\Omega})=\frac{3-\frac{1}{4}e^{-j\Omega}}{-\frac{1}{16}e^{-j2\Omega}+1}$$

c) If the unit impulse response of a LTI system is $h(n)=\alpha^n u(n)$. Find the response of the system to an input defined by $x[n]=\beta^n u(n)$. Where $\alpha,\beta<1$ and $\alpha\neq\beta$ **06**

UNIT - V

7 a) A causal system is represented by the difference equation **06**

$$y(n)+\frac{1}{4}y(n-1)=x(n)+\frac{1}{2}x(n-1)$$

i) Find the system function H(z) and corresponding ROC
ii) Find unit impulse response of the system in analytical form
iii) Find the frequency response of the system

b) The output of a discrete time LTI system is found to be **08**

$$2\left(\frac{1}{3}\right)^n u(n)$$

when the input x(n) is u(n)

i) Find the impulse response h(n) of the system
ii) Investigate the stability of the system
iii) Find the out y(n) when the input x(n) is $\left(\frac{1}{2}\right)^n u(n)$

c) Find the Z-transform of the following signal and specify its ROC **06**

$$i)x[n]=\left(-\frac{1}{2}\right)^n u(-n)+2\left(\frac{1}{4}\right)u(n)$$

$$ii)y[n]=\left(-\frac{1}{2}\right)^n u(n)+2\left(\frac{1}{4}\right)u(n)$$

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