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

Autonomous Institute Affiliated to VTU

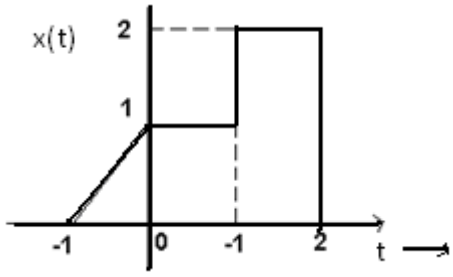
December 2023 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: Electronics and Communication Engineering **Duration: 3 hrs.**
Course Code: 22EC3PCSAS **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) Given x(t) as shown in figure 1(b) , Sketch the following **10**
i) x(2t-1)
ii) x(4-t)
iii) x(t)u(t)
iv) x(-t/2)
v) x(t)+x(-t)



b) Identify whether the signal is periodic or non-periodic, if periodic find the fundamental period **06**
i) $x(n) = \cos\left(\frac{n\pi}{12}\right) + \sin(\frac{n\pi}{18})$
ii) $x(n) = \cos\left(\frac{4n\pi}{13} + \pi\right)\Big)$

c) Plot the signal **04**
x(t)=u(t+2)+r(t+1)-r(t)-u(t-2) -u(t-4)

UNIT - II

2 a) For the following systems determine whether the system is Linear, Causal, Stable, Time- invariant and Memory less **10**

i) y(n) = ax[n] + b

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

b) A system consists of several subsystems connected as shown in figure 2(b). Find the operator H relating x(t) to y(t) for the subsystem operators given by; **06**

$H_1: y_1(t)=x_1(t)x_1(t-1)$
$H_2: y_2(t)=|x_2(t)|$

H_3:$y_3(t)=1+2x_3(t)$
H_4:$y_4(t)=\cos(x_4(t))$

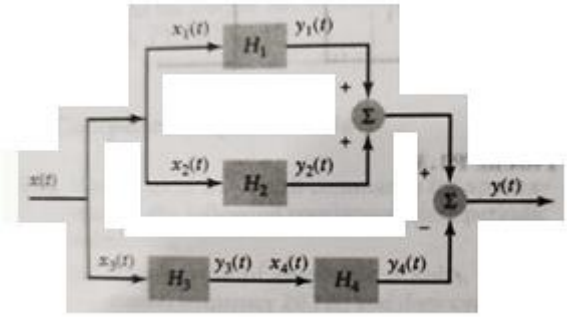


Figure 2(b)

c) Derive the condition for stability of an LTI discrete system. **04**

UNIT - III

3 a) Determine output y(t) for an input $x(t) = e^{-3t}\,u(t)$ and unit impulse response h(t) = u(t-2) using convolution integral . **06**

b) An LTI system is characterized by $h[n]=(1/4)^n u[n]$. compute the output of the system at time n=0,5&10, when input is x[n]=u[n] **08**

c) Consider two systems having impulse responses $h_1(t) = e^{-3t}\,u(t)$ and $h_2(t) = 2\,e^{-t}\,u(t)$ find the overall impulse responses when the systems are connected in i) Parallel and ii) series **06**

OR

4 a) For each impulse responses listed below. Determine whether the systems are memoryless , Causal and stable. **08**

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

$(ii)\ h(n) = \left(\frac{1}{3}\right)^n u(n+1)$

b) Find the natural response of the system described by **08**

y(n)+3y(n-1)+2y(n-2) = 2x(n)+3x(n-1) with initial conditions y(-1)=7

y(-2)=-3

c) Represent following difference equation in Direct form-I and Direct form-II block diagram representation. **04**

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

UNIT - IV

5 a) The unit impulse response of an LTI system is $h[n]=\alpha^n u[n]$. **10**
Find the response of the system using DTFT to an input defined by $x[n]=\beta^n u[n]$, where $\alpha, \beta < 1 \quad and \quad \alpha \neq \beta$

b) Find the DTFS representation of the given waveform shown in fig 5(b). **10**

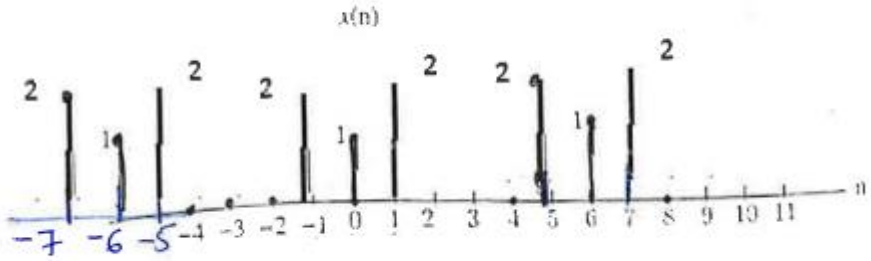


Figure 5(b)

OR

6 a) Find the DTFT for the following signal x(n) and draw its spectrum **08**
$X(n)=a^n u(n)$; magnitude of a<1.

b) Evaluate the DTFS representation for the signals **08**
i) $x(n)= \cos[(\pi/8)n]$
ii) $x(n)= \cos[(\pi/3)n] + \cos[(\pi/4)n]$

c) State and describe sampling theorem. **04**

UNIT - V

7 a) Solve the given difference equation using Unilateral Z transform for the given initial conditions y [-1] =2 and input.x[n]= u[n]. **06**
y(n) - 0.1 y(n-1) = x(n)

b) Find the Z-transform of the following sequences and find the ROC **08**

$i)$ $x[n] = \left[\frac{1}{2}\right]^n \sin\Omega_0 n\, u[n]$

$ii)$ $x[n] = \left(\frac{1}{2}\right)^n \{u[n] - u[n-10]\}$

c) A causal system is represented by the following difference equation **06**
y [n]-0.25y(n-2)=x(n)-0.5x(n-1)
a. Determine the system function H(z) and the corresponding ROC
b. Determine the impulse response of the system in analytical form

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