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

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main 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: 12.05.2023**

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.

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UNIT - I

1 a) Determine whether the following signal are periodic or not. If periodic find the period. **05**

(i) $x(t) = 3\cos(250\pi t) + 5\sin(200\pi t)$ (ii) $x[n] = e^{j(\frac{\pi}{4})n}$

b) Evaluate the following expressions **05**

(i) $\sum_{n=-\infty}^{\infty} e^{2n}\delta(n-2)$ (ii) $\sum_{n=-5}^{5} (\sin 2n)\delta(n+7)$

c) A signal y(t) is defined below. Sketch the signal and Perform the following operations **10**
(i)x(2t) (ii) x(2t+3) (iii) x(1-2t) (iv) x(-t-1)

if $x(t) = \begin{cases} (t+1); -1 \le t \le 0 \\ (-t+1); 0 \le t \le 1 \end{cases}$

UNIT - II

2 a) A system is defined as below **10**

$y(t) = x^2(-t)$

Check the system for following properties. Also show the mathematics behind all the properties.
(i) linearity (ii)memory (iii) causality (iv) time invariance (v) stability

b) A system is defined as below **10**

$y[n] = \sum_{k=n_0}^{n} x[k]$

Check the system for following properties. Also show the mathematics behind all the properties.
(i) linearity (ii)memory (iii) causality (iv) time invariance (v) stability

UNIT - III

3 a) The input x (t) and impulse response h (t) of a LTI system are given below. **10**
$x(t)=2u(t-1)-2u(t-3)$ And $h(t)=u(t+1)-2u(t-1)+u(t+3)$
Sketch x(t) and h(t). Find the output of the system and sketch the output.

b) An impulse response is given by **06**
$h[n]=\left(\frac{1}{2}\right)^n u(n+3)$. Test the following properties
(i) Memory (ii) causality (iii) stability

c) Draw the direct form 2 structure for the following system **04**
$$y(t)=x(t)+2\frac{d}{dt}x(t)+3\frac{d^2}{dt^2}x(t)-4\frac{d}{dt}y(t)+5\frac{d^2}{dt^2}y(t)$$

OR

4 a) The input x (t) and impulse response h (t) of a LTI system are given below. **10**
$x(t)=u(t+1)-u(t-1)$ And $h(t)=2x(t)$
Sketch x(t) and h(t). Find the output of the system and sketch the output.

b) Let $h_1(t),h_2(t),h_3(t),h_4(t)$ be impulse response of LTI systems. Construct a system with impulse response $h(t)$ using $h_1(t),h_2(t),h_3(t),h_4(t)$ as subsystems. Draw the interconnection of the systems to obtain **06**
(i) $h(t)=h_1(t)+\{h_2(t)*h_3(t)\}+h_4(t)$
(ii) $h(t)=h_1(t)*\{h_2(t)+h_3(t)\}*h_4(t)$

c) Draw the direct form 2 structure for the following system. **04**
$$\frac{d^2}{dt^2}y(t)+3\frac{d}{dt}y(t)+5y(t)=\frac{d}{dt}x(t)+4x(t)$$

UNIT - IV

5 a) Find the DTFT of following signals **08**
(i) $x[n]=(0.5)^{n+2}u[n]$

(ii) $x[n]=n(0.5)^{2n}u[n]$

b) State and prove frequency shift property of DTFT. **06**

c) Find the frequency response of $h[n]=\left(\frac{1}{2}\right)^n u(n)$ **06**

OR

6 a) State and prove time shift property of DTFS. **06**

b) Determine the Fourier series coefficients for the signal below. **08**
$$x[n]=1+\sin\Omega_0 n+3\cos\Omega_0 n+\cos(2\Omega_0 n+\frac{\pi}{2})$$

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c) Find the system transfer function for the following difference equation using DTFT **06**

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

Hence find the impulse response of the system.

UNIT - V

7 a) Find the Z transform of the signal and plot the ROC. **07**

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

b) Solve the following difference equation using Z transform **07**

$$y[n]-0.8y[n-1]=x[n]$$

where,input,$x[n]=(0.5)^n u[n]$,and,y[-1]=2

c) Discuss the properties of ROC with an example each. **06**

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