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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B. E. - Electronics and Electronics Engineering

Semester End Examination; July / August - 2022

Signals and Systems

Time: 3 hrs *Max. Marks: 100*

Course Outcome's

The Students will be able to:

CO1: Understand the classification of signals, relate between elementary signals and identify the properties of a system.

CO2: Perform convolution operation on continuous and discrete time signals. Apply the properties of impulse response representation.

CO3: Solve difference and differential equations and represent them as block diagrams.

CO4: Apply the properties of DTFS and DTFT to Discrete and continuous time signals.

CO5: Solve difference equations using Z-transforms

Note: *i) **PART-A** is compulsory. One question from each unit for maximum of 2 marks.*
*ii) **PART-B**: Answer any **TWO** sub questions (from a, b, c) from each unit for a Maximum of 18 marks.*

Q. No.	Questions	Marks
	I:PART - A	**10**
I a.	Check for Priodicity. If it is periodic signal find the period. $x(n)=\cos\left(\frac{n\pi}{12}\right)+\sin\left(\frac{n\pi}{18}\right)$	2
b.	Determine the convolution of u(t) with u(t).	2
c.	Obtain the block diagram representation using dirct form-II H for a system given by the differential equation. $\frac{d^2y}{dt^2}+\frac{5dy}{dt}+4y(t)=x(t)+\frac{3dx(t)}{dt}$	2
d.	Solve the following signal to find Fourier transform. $x(t)=\cos\omega_0 t$	2
e.	Define ROC with the help of ZT equation.	2
	II:PART - B	**90**
	UNIT - I	**18**
1 a.	Build the following signal and determine their even and odd components: $x(t)=r(t+2)-r(t+1)-r(t-2)+r(t-3)$	9
b.	Check for time invariant, causal and stability for the system represented by, $y(t)=2t\times(t)$	9
c.	Consider an energy signal $x(t)$ over the range -3 ≤ t ≤ 3 with energy E = 12 joules. Find the range of the signal and compute their signal energy for the following 1. X (3t) 2. 2x (t) 3. X (t – 4) 4. X (-t)	9

Contd….2

UNIT - II **18**

2 a. Given input $x(n)=2^n u(-n)$ and impulse response $h(n)=u(n)$ Draw $h(n)$ and $x(n)$; Find the response $Y(n)$ of the system. 9

b. State the different properties of impulse response and explain any two. 9

c. Analyze the f LTI system characterized by impulse response $h(n)=4^{-n}u(2-n)$ for Causal, Memory and stability. 9

UNIT - III **18**

3 a. Determine the response of first order discrete time system governed by the difference equation, $y(n)=-0.5y(n-1)+x(n)$ The input is Unit step and Initial condition $y(-1)=0$ 9

b. Determine the output of the LTI system characterized by the differential equation $\frac{d^2y(t)}{dt^2}+3\frac{dy(t)}{dt}+2y(t)=x(t)$ with initial condition $y(0)=3$ and $\frac{dy(t)}{dt}_{t=0}=-5$ for the input $x(t)=2u(t)$. 9

c. Determine the Fourier coefficient for the periodic signal $x(t)=e^{-t}$ with period T = 1 sec. Draw its amplitude and phase spectrum. 9

UNIT - IV **18**

4 a. Define and demonstrate the following properties of Discrete Time Fourier Transform:
i) Time Convolution Property
ii) Time Scaling property 9

b. Apply the property of Fourier transform to find X[w];

$$x(t)=\frac{2a}{a^2+(2\pi t)^2}$$

$$x(t)=(t+1);-1\le t\le 0$$

$$=(-t+1);0\le t\le 1$$

9

c. The differential equation of the system is given as,

$$\frac{d^2}{dt^2}y(t)+5\frac{d}{dt}y(t)+6y(t)=-\frac{d}{dt}x(t)$$

Determine the frequency response and impulse response of the system. 9

UNIT - V **18**

5 a. Expand the properties of ROC of Z-transforms. 9

b. Determine the Z transform of $x(n)=-u[-n-1]+\left[\frac{1}{4}\right]^n u(n)$. Depict the poles and zeroes with ROC on the Z – plane. 9

c. Find the inverse ZT of $x[z]=\frac{z(z-1)}{(z+1)(z+2)^3}; ROC|Z|>2$. 9

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