



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 Periodicity. 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 direct form-II H for a system given by the differential equation.	2
	$\frac{d^2 y}{dt^2} + \frac{5dy}{dt} + 4y(t) = x(t) + \frac{3dx(t)}{dt}$	
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 $-3 \leq t \leq 3$ 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

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 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 $\frac{d^2 y(t)}{dt^2} + 3 \frac{dy(t)}{dt} + 2y(t) = x(t)$ with initial condition $y(0) = 3$ and $\frac{dy(t)}{dt} \Big|_{t=0} = -5$ 9
for the input $x(t) = 2u(t)$.
- 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 9
 - ii) Time Scaling property
- b. Apply the property of Fourier transform to find $X[w]$;

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

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

$$= (-t+1); 0 \leq t \leq 1$$
9
- c. The differential equation of the system is given as,

$$\frac{d^2}{dt^2} y(t) + 5 \frac{d}{dt} y(t) + 6y(t) = -\frac{d}{dt} x(t)$$
9
Determine the frequency response and impulse response of the system.

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