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

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; March - 2021

Signals and Systems

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Apply knowledge of basic mathematics to classify different signals and systems.

CO2: Analyze signals and systems to determine their properties.

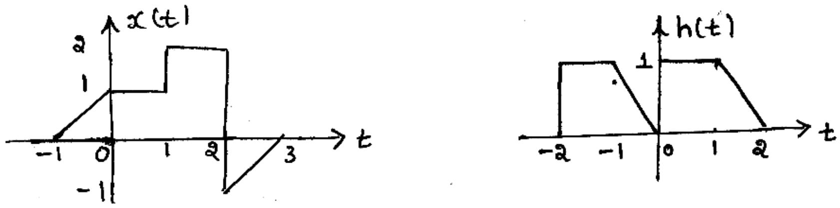
CO3: Analyze LTI/LSI systems in time domain and frequency domain to determine system output and properties.

CO4: Analyze CT and DT system and implement using different structures.

CO5: Commenting on existing demo, group activity based learning new tools and solving problems using tools.

Note:* I) PART - A** *is compulsory.* ***Two *marks for each question.*

II) PART - B*: Answer any* ***Two*** *sub questions (from a, b, c) for Maximum of* ***18 marks*** *from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
I a.	Determine the average power of the signal $x(t) = A\cos(w_0 t + \theta)$.	2	L2	CO1	PO1
b.	Check whether the LTI system with impulse response $h(t) = e^{-4\|t\|}$ is stable or not.	2	L2	CO2	PO2
c.	Compute the Fourier Transform of the unit impulse function.	2	L2	CO3	PO2
d.	Find DTFT of the signal $x(n) = \{1, 3, \underset{\uparrow}{5}, 3, 1\}$.	2	L2	CO3	PO2
e.	Determine unilateral Z-Transform of $x(n) = a^n u(n+5)$.	2	L2	CO3	PO2
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	Determine whether the following signals are periodic or not. Find its fundamental period: i) $x(t) = \sin^2(4t)$ ii) $x(n) = \cos\left(\pi/_5\, n\right)\sin\left(\pi/_3\, n\right)$ iii) $x(n) = cos\left(\pi/_2\, n\right) - \sin\left(\pi/_8\, n\right) + 3\cos\left(\pi/_4\, n + \pi/_3\right)$	9	L2	CO2	PO2
b.	Consider the signals $x(t)$ and $h(t)$ shown in Fig. Q2(b). Sketch; i) $x(t-1)h(1-t)$ ii) $x(1-t)h(t-1)$ 	9	L2	CO2	PO2
c.	For the systems given below, determine whether it is linear, time invariant and memory system; i) $y(t) = x(-t)$ ii) $y(n) = x(n).x(n-1)$ iii) $y(t) = x(t).\cos(w_0 t)$	9	L3	CO2	PO2
	UNIT - II	**18**			
2 a.	A LTI system characterized by the impulse response, $h(t) = t[u(t) - u(t-1)]$ with an input $x(t) = t[u(t) - u(t-2)]$ find and sketch the output of the LTI system.	9	L3	CO3	PO2

b. Solve the forced response for the difference equation,

$$y(n)-\frac{1}{4}y(n-1)-\frac{1}{8}y(n-2)=x(n)+x(n-1) \text{ with } x(n)=\left(\frac{1}{8}\right)^n u(n).$$

9 L3 CO3 PO2

c. Sketch direct form-I and direct form-II for the systems defined below;

i) $y(n)+\frac{1}{2}y(n-1)-y(n-3)=3x(n-1)+2x(n-2)$

ii) $2y(t)+\frac{1}{3}\frac{d}{dt}y(t)-\frac{1}{8}\frac{d^2}{dt^2}y(t)=2x(t)+3\frac{d}{dt}x(t)$

9 L3 CO4 PO3

UNIT - III

18

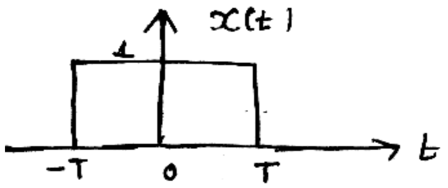
3 a. State and prove the following properties of Fourier transform:
i) Time-shift ii) Modulation iii) Parseval's Theorem

9 L2 CO3 PO2

b. Compute the Fourier series representation for the signal $x(t)=\sin(2\pi t)+\cos(3\pi t)$ and draw its spectrum.

9 L2 CO3 PO2

c. Obtain the Fourier Transform of the signal;
i) $x(t)=e^{-at}u(t)$ ii) Find FT of



Using time differentiation property.

9 L2 CO3 PO2

UNIT - IV

18

4 a. State and explain sampling theorem. Along with a neat sketch, explain the reconstruction of signals from its samples.

9 L2 CO3 PO2

b. Determine the Nyquist rate corresponding to the following signal:

i) $x(t)=6.\cos(640\pi t).\cos(840\pi t)$

ii) $x(t)=Sinc(200t)+Sinc^2(200t)$ iii) $x(t)=\cos^3(200\pi t)$

9 L2 CO1 PO1

c. Obtain the frequency response and the impulse response of the system having the output $y(n)$ for the input $x(n)$ as given below;

$$x(n)=\left(\frac{1}{2}\right)^n u(n) \text{ and } y(n)=\left(\frac{1}{4}\right)\left(\frac{1}{2}\right)^n u(n)+\left(\frac{1}{4}\right)^n u(n)$$

9 L2 CO3 PO2

UNIT - V

18

5 a. Find the Z-transform for the following signals. Also indicate ROC for the signal:

i) $x(n)=\alpha^{|n|}$; $\alpha<1$

ii) $x(n)=n.a^n.u(n)$; $a<1$

9 L2 CO3 PO2

b. Solve for the inverse Z-transform of;

$$X(z)=\frac{4-3z^{-1}+3z^{-2}}{(1+2z^{-1})(1-3z^{-1})^2} \quad ; \quad |z|>3$$

9 L2 CO3 PO2

c. Solve for the difference equation;

$y(n)-\frac{1}{9}y(n-2)=x(n-1)$ with the initial condition $y(-1)=0$, $y(-2)=1$ and $x(n)=3u(n)$ using unilateral Z-transform.

9 L2 CO3 PO2

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