U.S.N

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

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Semester End Examination; May / June - 2019

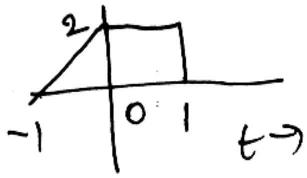
Signals and Systems

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. For the waveform shown in below figure. Sketch i) $2x(2t)+1$ ii) $x(2t)-1$. 10



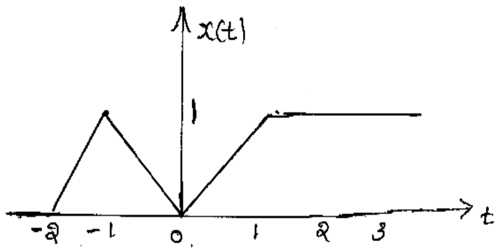
b. Check whether the following signals are periodic or not, if periodic, find its fundamental period : 10

$i)\ x(t)=\cos(t)+\sin\sqrt{2}t$ $ii)\ x(n)=\cos\left(\frac{1}{5}\pi n\right)-\sin\left(\frac{1}{3}\pi n\right)$

2 a. Determine whether the following systems are linear, time invariant, casual, memory and stable; 10

$i)\ y(t)=x(t)+g(t)$ $ii)\ y(n)=n.x(-n+2)$

b. Sketch even and odd part of the signal, 6



c. Find the total energy of the signal $x(t)=\begin{cases} t+5; & -5\le t\le -4 \\ 1; & -4\le t\le 4 \\ -t+5; & 4\le t\le 5 \\ ; & else \end{cases}$ 4

UNIT - II

3 a. The impulse response of the LTI system is given $h(n) = \alpha^{n}u(n)$. Determine the output of the LTI system, if input to the system is $x(n) = \alpha^{-n}u(-n)$. 10

b. Determine whether the following LTI systems represented by impulse responses are memory less, causal and stable : 10

$i)\ h(n)=\cos\left(n\frac{\pi}{4}\right)\left[u(n)-u(n-4)\right]$ $ii)\ h(n)=n\left(\frac{1}{2}\right)^{n}u(n)$ $iii)\ h(n)=\left(\frac{1}{3}\right)^{n}\delta(n)$

4 a. A LTI system characterized by the impulse response $h(t)=t\left[u(t)-u(t-1)\right]$ and the input to the system is $x(t)=\left[u(t)-u(t-2)\right]$. Find the output of the system. 10

Contd... 2

b. State any two properties of convolution and prove them. 10

UNIT - III

5 a. Find the forced response for the system given by the difference equation,

$y(n)-\frac{1}{4}y(n-1)-\frac{1}{8}y(n-2)=x(n)-x(n-1)$ with input $x(n)=\left[\frac{1}{8}\right]^n u(n)$. 10

b. Draw the direct form-I and direct form-II implementation for the system described by the differential equation $\frac{d^3y(t)}{dt^3}+2\frac{d}{dt}y(t)+3y(t)=x(t)+3.\frac{d}{dt}x(t)$ 6

c. State and prove time shift property of Fourier series. 4

6 a. Determine the FS representation for the signal $x(t)=\cos 4t+\sin 8t$. Draw the magnitude and phase spectrum. 10

b. Find the forced response for the system,

$\frac{d^2y(t)}{dt2}+5.\frac{d}{dt}y(t)+6y(t)=2x(t)+\frac{d}{dt}x(t)$ with input $x(t)=2e^{-t}u(t)$. 10

UNIT - IV

7 a. State and prove;

i) Convolution ii) Parseval's Theorem properties of DTFT 10

b. Find the Fourier transform of $x(t)=e^{-a|t|}; a>0$. Draw its spectrum. 10

8 a. Evaluate the DTFT of the signal $x(n)=\delta(6-3n)$. Sketch its magnitude and phase spectrum. 10

b. The impulse response of a continuous time LTI system is given by,

$h(t)=\frac{1}{RC}e^{-t/RC}.u(t)$. Find the frequency response and plot its magnitude and phase spectrum. 10

UNIT - V

9 a. Find the Z-transform of the following Signal :

$i)\ y(n)=1/2^n.u(n)*(1/3)^n u(n)$ $ii)\ x(n)=Sin\left(\frac{\pi}{8}n-\frac{\pi}{4}\right)u(n-2)$ 10

b. What is Region of convergence of *x*(*z*)? List the properties of ROC. 6

c. State and prove initial value theorem as applied to one sided Z-transforms. 4

10 a. A casual system has input *x(n)* and output *y(n)*. Find the impulse response of the system if,

$i)\ x(n)=\delta(n)+\frac{1}{4}\delta(n-1)-\frac{1}{8}\delta(n-2)$ $ii)\ y(n)=\delta(n)-\frac{3}{4}\delta(n-1)$ 10

b. Find the inverse Z-transform of the following signal

$i)\ x(z)=\frac{z^2-3z}{z^2+\frac{3}{2}z-1}$; $\frac{1}{2}<|z|<2$ using partial fraction expansion method 10

$ii)\ x(z)=\frac{1}{1+\frac{1}{2}z^{-1}}$; $|z|<1$ using long division method.

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