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

(An Autonomous Institution affiliated to VTU, Belgaum)

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

Semester End Examination; June/July - 2015

Signals and Systems

Time: 3 hrs Max. Marks: 100

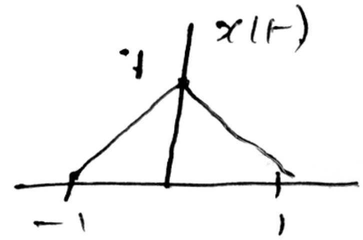
***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each **Unit**.*
ii) Assume suitable missing data if any.

UNIT - I

1. a. Determine the periodicity of the continuous signal given by $x(t) = 2\cos\frac{2\pi t}{3} + 3\cos\frac{2\pi t}{7}$ and prove the same. 8

b. Determine the even and odd parts of $x(t) = \sin 2t + \cos t + \sin t \cos 2t$ 6

c. A triangular pulse $x(t)$ is shown below. Sketch (i) $y_1(t) = x(2t)$ (ii) $y_2(t) = x(-2t-1)$ (iii) $y_3(t) = x[2(t-2)]$ 6



2 a. Determine the power and Energy of the $x(t) = 3\cos 5\Omega_0 t$ 8

b. For the system given by $y(n) = \sum_{k=n_0}^{n} x(k)$ determine, whether the system is (i) memory less (ii) linear (iii) Time in variant (iv) Casual (v) Stable 6

c. Plot the standard continuous time signals. Write the functional relations of each of it. 6

UNIT - II

3 a. Perform the convolution of the following signals by graphical method. $x_1(t) = e^{-3t}u(t)$, $x_2(t) = t\,u(t)$. 10

b. Determine the linear convolution of the function: 10

$$x(n) = \begin{cases} 1 & for\ n = \pm 1 \\ 2 & for\ n = 0 \\ 0, & otherwise \end{cases} \qquad h(n) = \begin{cases} 2 & n = 0 \\ 3 & n = 1 \\ -2 & n = 2 \\ 0 & otherwise \end{cases}$$

Contd…2

4 a. A LTI system has impulse response given by $h(n) = u(n) - u(n-7)$. Determine the output of the system when the input is $x(n) = 2[u(n-2) - u(n-5)]$. 10

b. Consider the linear Time variant system with impulse response $h(n) = \left[\frac{j}{2}\right]^n u(n)$. Determine the steady state response for large n, to the excitation $x(n) = \cos \pi n \, u(n)$ 10

UNIT - III

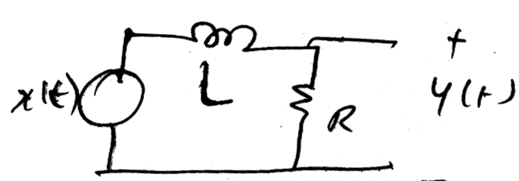
5 a. Find the zero-input response and zero-state response and hence find total response of the functions given by $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{d}{dt}x(t)$ 8

given by $y(0) = 0,\quad \left.\frac{dy(t)}{dt}\right|_{t=0} = 1 \qquad x(t) = e^{-2t}u(t)$

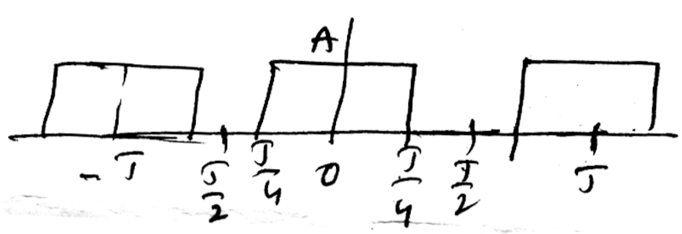
b. Draw the direct form I and direct form II block diagram representatives of the system described by $\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + 3y(t) = 4\frac{dx(t)}{dt} + 5x(t)$. 6

c. What are the conditions to be satisfied for the Fourier representation of a signal? Write the three forms of CTFS of periodic signal. 6

6. a The impulse response of the circuit shown is $h(t) = \frac{R}{L}e^{-\left(\frac{R}{L}\right)t}u(t)$. Find the expression for the frequency response and plot the magnitude of phase response. 10



b. Determine the trigonometric form of Fourier series of the wave forms. 10



UNIT - IV

7 a. State and prove linearity time shifting, frequency shifting and symmetry property of DTFT. 10

b. Use partial fractions expansion and linearity to determine the inverse Fourier transfer in the following functions. 10

(i) $x(jw)=\dfrac{-jw}{(jw)^2+3jw+2}$ (ii) $x(jw)=\dfrac{4}{-w^2+4jw+3}$

8 a. Find the DTFT of the following finite durations sequence of length L. $x(n)=\begin{cases}A & for\ 0\le n\le L-1\\ 0 & otherwise\end{cases}$ also find the inverse DTFT to verify x(n) for L = 3 and A = 1 V. 10

b. Determine the IDFT of $x(n)=\{3,\ (2+j),\ 1,(2-j)\}$ 10

UNIT - V

9 a. Find the initial value $x(0)$ and final value $x(\infty)$ of the following Z- domain 8

(i) $X(z)=\dfrac{1}{1-z^{-2}}$ (ii) $X(z)=\dfrac{2z}{z^2-1.8z+0.8}$

b. Find the one sided Z-transform of the discrete time signal generates by mathematically simplify of Cartesians time signal $x(t)=e^{-at}\sin\Omega_o t$ 6

c. Find the Z-transform of the following sequences (i) $x(n)=3\left(\frac{1}{2}\right)^n u(n)-2(3)^n u(-n-1)$ 6

(ii) $x(n)=\left(\frac{1}{2}\right)^n\left[u(n)-u(n-10)\right]$ Write Time shifting property and linearity property.

10 a. Determine the IZT of $X(z)=\dfrac{1}{1-1.5z^{-1}+0.5z^{-2}}$ for ROC $|z|>1$, $\frac{1}{2}<|z|<1$, $|z|<\frac{1}{2}$ 10

b. The impulse response of a discrete line LTI system is given by $h(n)=\left(\frac{1}{2}\right)^n u(n)+\left(-\frac{1}{3}\right)^n u(n)$ Find the Z-transform of $h(n)$ and its ROC and hence find 10

(i) is the system casual or non-casual

(ii) is the system is stable

(iii) Obtain the difference equation realization of the system.

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