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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; Dec - 2017 / Jan - 2018

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. Sketch the waveforms for the following signals : 8

i) $x_1(t) = u(t+2) - 2u(t) + u(t-2)$ ii) $x_2(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$.

b. Find the odd and even components of the following signals : 4

i) $x(t) = \sin c(t)$ ii) $x(t) = e^{jt}$.

c. For the following system, determine whether the system is : 8

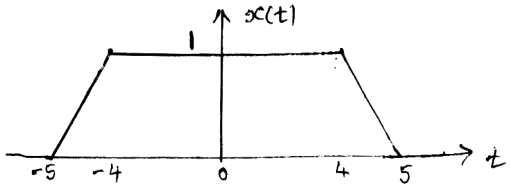
i) Linear ii) Time-invariant iii) Memory iv) Causal

I) $y(t) = (t+10)x(t)$ II) $y(n) = x(n)x(n-1)$.

2 a. Determine whether the following signals are periodic or not. If periodic find its fundamental period : 8

i) $x(n) = Re\left\{e^{i\frac{\pi}{3}n}\right\} + \mathrm{Im}\left\{e^{i\frac{\pi}{10}n}\right\}$ ii) $x(t) = \cos\left(\sqrt{2}t\right) + \cos(t)$.

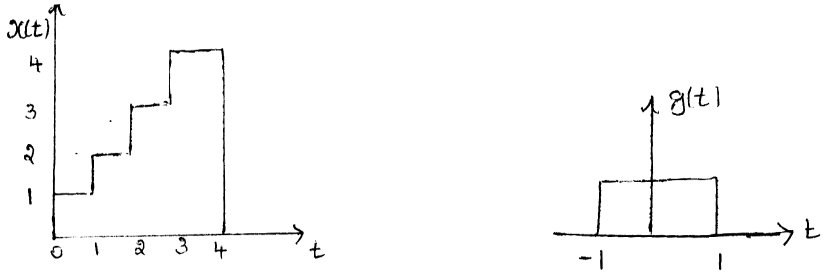
b. Find the energy for the signal *x(t).* 4



c. Find the power of the signal, 4

$x(t) = A\sum_{K=-\infty}^{\infty} rect(t-2K)$.

d. Construct the signal *x(t)* in terms of *g(t):* 4



UNIT - II

3 a. Convolute the sequence $x_1(n)$ and $x_2(n)$ 8

$x_1(n) = \alpha^n u(n)$ and $x_2(n) = \beta^n u(n)$ for $\alpha = \beta$ and $\alpha \neq \beta$

b. State and prove : 6

i) Commutative ii) Associative property of convolution sum.

c. Determine whether each of the system is : 6

i) Memoryless ii) Causal iii) Stable

I) $h(n) = \delta(n) + \sin(n\pi)$ II) $h(n) = e^{2n}\, u(n-1)$.

Contd….2

4 a. Determine the zero-state response for the system described by difference equation: 8

$y(n) - \frac{5}{6}\, y(n-1) + \frac{1}{6} y(n-2) = x(n)$ where $x(n) = 2^n \;;\; n \geq 0.$

b. Draw direct-I and direct-II structure for the differential equation, 6

$\frac{d^2 y(t)}{dt^2} + 5\frac{d}{dt} y(t) + 4y(t) = x(t) + 3\frac{d}{dt} x(t).$

c. Find the response of the system for the input $x(t) = u(t-1)$ with impulse response $h(t) = u(t-2)$. 6

UNIT - III

5 a. Explain the orthogonality of complex sinusoidal signals. 6

b. State and prove : 8

i) Time shift ii) Parseval's properties of CTFS.

c. Find the Complex Fourier coefficient for : 6

$x(t) = \cos\left(\frac{2\pi}{3} t\right) + 2\cos\left(\frac{5\pi}{3} t\right).$

6 a. State and prove : 10

i) Convolution ii) Modulation property of CTFT.

b. Find the FT of a rectangular pulse described by : 10

$x(t) = \begin{cases} 1 & ; |t| < a \\ 0 & ; |t| > a \end{cases}.$

UNIT - IV

7 a. Find the DTFT for the signal : 10

i) $x(n) = 2^n u(-n)$ ii) $x(n) = a^{|n|} \;;\; |a| < 1.$

b. State and prove : 10

i) Linearity ii) Frequency differentiation property of DTFT.

8 a. State and prove sampling theorem. 8

b. With interpolation formula, explain signal reconstruction. 6

c. Find the Nyquist rate for the signals, 6

i) $x(t) = \sin c^2(200t)$ ii) $x(t) = \cos(150\pi t)\sin(100\pi t).$

UNIT - V

9 a. Find the ZT of the following signals and determine the ROC : 10

i) $x(n) = (1+n)u(n)$ ii) $x(n) = -b^n u(-n-1).$

b. Find the inverse Z-transform of : 6

i) $X(z) = \frac{z^4 + z^2}{\left(z - \frac{1}{2}\right)\left(z - \frac{1}{4}\right)}$ *with* $|z| > \frac{1}{2}$ ii) $X(z) = \frac{1 - z^1}{z^{-1} - a} \;;\; |z| > a.$ 4

10 a. A system has impulse response $h(n) = \left(\frac{1}{3}\right)u(n) + \left(\frac{2}{3}\right)\left(-\frac{1}{2}\right)^n u(n)$. determine the input to the system if the output is given by, 10

$y(n) = \left(\frac{1}{3}\right) u(n) + \left(\frac{2}{3}\right) \left(-\frac{1}{2}\right)^n u(n).$

b. Find unilateral Z – Transform : 10

i) $y(n) = x(n-2)$; *where* $x(n) = \alpha^n$ ii) $x(n) = \{2, 4, \underset{\uparrow}{5}, 7, 0, 1\}.$

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