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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

Fundamentals of Signals

Time: 3 hrs *Max. Marks: 100*

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

UNIT - I

1 a. Define a signal and a system. Explain any two properties of a LTI system. 6

b. Check whether the following signals are periodic or not. If periodic, determine their fundamental period.

(i) $x(n)=\cos\left(\frac{n\pi}{7}\right)\sin\left(\frac{\pi n}{2}\right)$ (ii) $x(n)=\cos n\pi\left[u(n+4)-u(n-5)\right]$ 8

(iii) $x(t)=\left[2\cos^2\left(\frac{\pi t}{2}\right)-1\right]\cos\pi t.$

c. Sketch the following signals : 6

(i) $r(t) - r(t - 1) - r(t - 3) + r(t - 4) = r_1(t)$ (ii) $r_2(t) = r(-0.25t + 1)$.

2 a. For the system given below, determine whether the system is (i) Linear (ii) Time invariant (iii) Casual (iv) Stable (v) Memoryless 10

(I) $y(t)=x\left(t/2\right)$ (II) $y(n)=2x(n)-u(n).$

b. What is the difference between odd and even signal? 5

c. Determine the stability, casuality of the system $y(n)=\sum_{k=-\infty}^{n}x(k).$ 5

UNIT - II

3 a. For the difference equation given, find the complete response; 10

$y(n)-\frac{1}{9}y(n-2)=x(n-1)$ with $y(-1) = 1, y(-2) = 0$ and $x(n) = u(n)$.

b. Draw the direct from I and direct from II Implementation for the system given below: 10

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

4 a. Perform the convolution Integral of the following signals : 10

$x(t)=e^{t}u(-t)$ $h(t)=e^{t}u(t).$

b. Explain convolution sum procedure for the given signal with neat diagrams at each stage 10

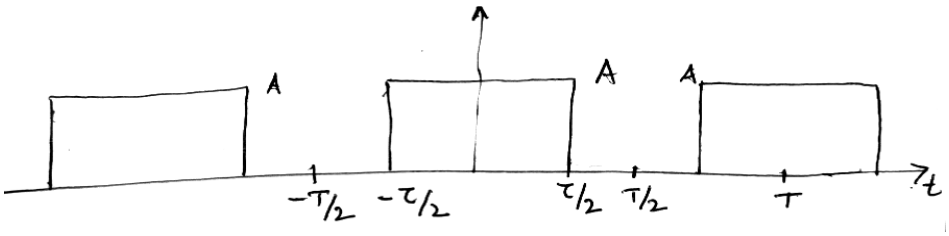
$x(n)=\{\underset{\uparrow}{0},1,2,3,4\}$, $h(n)=\{1,1,\underset{\uparrow}{1},1,1\}.$

UNIT - III

5 a. State and prove the time shift and convolution properties of fourier series. 10

b. Determine the fourier series representation of the waveform shown below. 10

Contd…2



6 a. State and prove the time shift and time differentiation properties of fourier transform. 10

b. Find the fourier transform of the following signals : 10

(i) $x(t)=e^{-t-1}u(t)$ (ii) $x(t)=e^{-t-j\pi t}u(t)$.

UNIT - IV

7 a. State and prove Parseval's theorem as applied to DTFS. 6

b. Determine the complex FS for the periodic discrete time signal; 8

$$x(n)=2+\cos\left(\frac{3\pi n}{8}\right)+2\sin\left(\frac{\pi n}{2}\right)-\sin\left(\frac{7\pi n}{8}\right).$$

c. Determine the DTFT of the following signals : 6

(i) $x(n)=(n+1)a^n u(n)$ (ii) $Z(n)=\left\{a^{2n}+a^{n+n_0}\right\}u(n)$.

8 a. State and explain sampling theorem. 5

b. Explain the process of reconstruction of continuous time signals from sampler. 7

c. Determine the Nyquist sampling rate and Nyquist Sampling interval for 8

(i) $x_1(t)=2\sin(100\pi t)$ (ii) $x_2(t)=\sin C(100\pi t)+3\sin C^3(60\pi t)$

(iii) $x_3(t)=\frac{1}{2}\sin C(100\pi t)+\frac{1}{2}\sin C(50\pi t)$.

UNIT - V

9 a. Explain any three properties of ROC of Z-transform with an example. 6

b. Find the Z-transform of the following sequence; 8

(i) $x_1(n)=-u(-n-1)+\left(\frac{1}{2}\right)^n u(n)$ (ii) $x(n)=2^{|n|}$.

c. Find the inverse Z-transform of $X(Z)$ using partial fraction approach; 6

$$X(Z)=\frac{Z^2}{Z^2-\frac{3}{2}Z+\frac{1}{2}}, \qquad |Z|>1.$$

10 a. Solve the difference equation $y(n)+2y(n-1)=x(n)$ with $x(n)=\left(\frac{1}{3}\right)^n u(n)$ and $y(-1)=1$. 10

b. Determine whether the following system is casual and stable; 4

$$H(Z)=\frac{1+2Z^{-1}}{1+\left(\frac{6}{5}\right)Z^{-1}+\left(\frac{9}{25}\right)Z^{-2}}.$$

c. If $h(n)=\left(\frac{1}{3}\right)^n u(n)+\left(\frac{1}{2}\right)^{n-2}u(n-1)$. 6

Determine the transfer function and difference equation.

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