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

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, B.E. - Electronics and Communication Engineering
Semester End Examination; Dec - 2016/Jan - 2017
Signals and Systems

Time: 3 hrs Max. Marks: 100

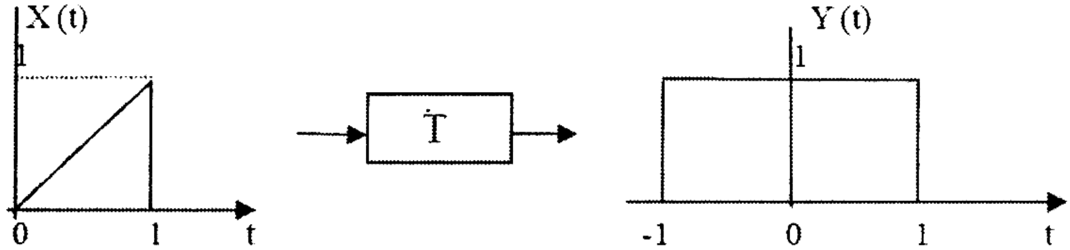
***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. For the following system, illustrate whether the system is linear, time invariant, memory, causal and stable? 6

i) $y(n) = g(n)x(n)$ ii) $y(t) = x^2(t)$ iii) $y[n] = \sum_{K=n_0}^{n} x(k)$.

b. A system T has input-output pairs given as shown in figure below. Determine whether the system is memory less and causal. 6



c. Identify whether the following signals are energy or power signals? Also find its energy and Power. 8

i) $A\exp(\alpha + j\omega)t$ ii) $2\exp(j3n)$.

2 a. Given a sequence $x(n) = (6-n)[u(n)-u(n-6)]$. Make a sketch of, 6

i) $y_1(n) = x(4-n)$ ii) $y_2(n) = x(2n-3)$.

b. Determine whether the given signals are periodic. Determine the fundamental period, if periodic, 8

i) $x(n) = \cos[0.125\pi n]$

ii) $x(n) = \mathrm{Re}\{\exp(jn\pi/12)\} + 1m\{\exp(ejn\pi/18)\}$

iii) $x(t) = \cos^2(2\pi t)$

iv) $x(n) = \exp(jn\pi/16)\cos[n\pi/17]$.

c. Find whether the following system is invertible; 6

i) $Y(t) = 10x(t)$ ii) $Y(t) = x^2(t)$

UNIT - II

3 a. An LTI system is characterized by $h(n) = \left(3/4\right)^n u[n]$. Compute the output of the system at tine n = 5, -5, 10, when input $x[n] = u[n]$. 10

b. Prove the following identities,

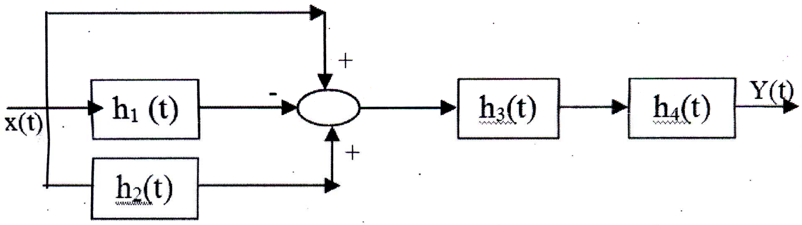
i) $X[n]^* \delta[n] = X[n]$

ii) $X[n]^* \delta[n-n_0] = x[n-n_0]$

iii) $x(n)^* u(n) = \sum_{k=-\infty}^{n} x[K]$

iv) $x(n)^* u(n-n_0) = \sum_{k=-\infty}^{n-n_0} x[K]$. 10

4 a. Find the overall impulse response *h(t)* in terms of the impulse response for the system shown in figure below. 4



b. Given $h(t) = e^{-t}u(t)$ and $x(t) = e^{-3t}\{u(t) - u(t-2)\}$. Determine; $y(t)$ using convolution integral. Also plot $y(t)$. 8

c. Represent following difference equation in Direct form-I and Direct form-II block diagram representation, 8

$$y(n) + 0.5y(n-1) - 0.25y(n-2) + 0.33y(n-3) = x(n) + 3x(n-1) + 2x(n-2).$$

UNIT - III

5 a. Evaluate the DTFS representation for the signal, $x(n) = \sin\frac{4\pi}{21}n + \cos\frac{10\pi}{21}n + 1$. Sketch magnitude and phase spectra. 10

b. State and Prove Parseval's theorem using DTFS definition. 10

6 a. Consider the Signal, 10

$$x(n) = 2 + 2\cos\frac{\pi}{4}n + \cos\frac{\pi}{2}n + \frac{1}{2}\cos\frac{\pi}{4}n$$

i) Determine and sketch its power density spectrum

ii) Evaluate the power of the signal

b. Find FS coefficients for the periodic signal $x(t)$ with period 2 and $x(t) = e^{-t}$ for -1 < t < 1. 10

Contd......3

UNIT - IV

7 a. Find the Fourier transform of the rectangular pulse sequence, $x(n)=u[n]-u[n-N]$. 10

b. Find the DTFT for the following signal, $x(n)$ and draw its spectrum $x(n)=a^n u(n)$; magnitude of a < 1. 10

8 a. State and Explain Sampling theorem. 8

b. Using Convolution Theorem find inverse Fourier transform of $X(jw)=\frac{1}{(a+jw)^2}$. 6

c. Use Parseval's theorem to evaluate : 6

$$x=\sum_{n=-\infty}^{\infty}\frac{\sin^2(Wn)}{\pi^2 n^2}.$$

UNIT - V

9 a. Find the Z-Transform of, 10

i) $x[n]=\left(-3/4\right)^n u(n)+2\left(1/2\right)^n u(n)$. Specify its ROC.

ii) $x[n]=\left(1/3\right)^n \sin\left(\pi n/4\right)u(n)$. Determine its ROC. Analyze Pole Zero Plot.

b. Find the inverse Z-transform using partial fraction expansion method, 10

$$x(z)=\frac{1+2Z^{-1}+Z^{-2}}{1-\frac{3}{2}Z^{-1}+\frac{1}{2}Z^{-2}} \quad |Z|>1$$

10 a. A causal system is represented by the following difference equation, 10

$y(n)+0.25y(n-1)=x(n)+0.5x(n-1)$,

i) Determine the system function *H(Z)* and the corresponding ROC.

ii) Determine the unit sample response of the system in analytical form.

b. Solve the difference equation $y(n)+3y(n-1)=x(n)$ with $x(n)=u(n)$ and the initial condition y(-1) = 1 using Z-Transform method. 10

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