Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

FOURTH SEMESTER B.TECH. (INSTRUMENTATION AND CONTROL ENGG.)

END SEMESTER EXAMINATION APRIL/MAY 2017

SUBJECT: SIGNALS AND SYSTEMS [ICE 2201]

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Determine whether the following signals are periodic. If they are periodic find the fundamental period.

(i) x(t)= $(\cos(2\pi t))^2$ (ii) $x(n)=(-1)^{n^2}$

1B. For x(n) ={ 1,0, -2, -1, 4, 3}, plot x(n), x(-n-3), x(2n+1) .
↑

1C. Find the energy and power of the signal $x(t)=u(t+2)-2u(t+1)+2u(t-1)-u(t-2)$

1D Investigate the signal $y(t) = t^2x(t)$ for causality, linearity, stability and time invariance.

(2+3+3+2)

2A. Input x(t) and impulse response h(t) of a LTI system is given by $x(t)=u(t+2)-u(t-2)$ and $h(t)=u(t)-u(t-10)$ .Use convolution integral to evaluate the output y(t) of the system and sketch *y(t).*

2B. Draw direct form I and direct form II implementations for the system
$y[n]+0.25y[n-1]-0.75y[n-2]=x[n]+0.5x[n-1]$

2C. Evaluate the step response of LTI System with impulse response $h(t)=e^{-|t|}$

(5+3+2)

3A. Find the natural response and forced response of the system described by the differential equation for $x(t)=e^{-t}u(t)$

$$\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+6y(t)=x(t) \;\; ; y(0-)=1 \text{ and } \frac{dy(0-)}{dt}=2$$

3B. Evaluate appropriate Fourier representation and sketch magnitude and phase specta of
$x(n)=1+\cos\left(\frac{4\pi}{21}n\right)+\sin\left(\frac{10\pi}{21}n\right)$.

3C. Obtain the appropriate Fourier representation of $x(t)=\sum_{k=-\infty}^{+\infty}\delta(t-\frac{1}{2}k)+\delta(t-\frac{3}{2}k)$

(5+3+2)

4A. A LTI system is described by

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

Determine (i) Frequency response of the system (ii) impulse response of the system.

4B Determine and sketch the Fourier transform of

$x(t) = \frac{\cos(95t)\sin(7t)}{\pi t}$

4C Evaluate $X = \sum_{n=-\infty}^{\infty} \frac{Sin^2(10\pi n)}{\pi^2 n^2}$ (5+3+2)

5A. A signal $x(t) = 1+\cos(\pi t)+\sin(4\pi t)$ is passed through a filter with an impulse response $x(t) = \frac{2\sin(\pi t)\cos(4\pi t)}{\pi t}$ Use Fourier transform to find the output of the filter.

5B. Obtain and plot Fourier transform spectra of $x(n) = 2+\sin\left(\frac{4\pi}{21}n\right)+\cos\left(\frac{10\pi}{21}n\right)$

5C. Identify Nyquist sampling rate for the signal *x(t) = z(t) y(t)* where

$Z(j\omega) = u(\omega+\pi/2T)-u(\omega-\pi/2T)$ and $Y(j\omega) = u(\omega+\pi/4T)-u(\omega-\pi/4T)$

(5+3+2)

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