## MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institution of Manipal University

## FOURTH SEMESTER B.TECH. (INSTRUMENTATION & CONTROL ENGG.)

## END SEMESTER EXAMINATIONS JUNE 2017

## SUBJECT: SIGNALS AND SYSTEMS [ICE - 2201]

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MAX. MARKS: 50

Instructions to candidates

Answer ALL 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) = sin(2t) + cos(3t) (ii) x(n) = cos(2πn)

- 1B. Determine odd and even parts of the signal (i)  $x(t) = 1 + t\cos(t) + t^2\sin(t)$  (ii) x(n) = u(n)
- 1C. Find the energy and power of the signal  $x(t) = 5\cos(\pi t)$ ,  $-\infty < t < \infty$
- 1D Investigate the signal y(t) = nx(n) 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-4) and h(t) = u(t) + u(t-1) 2u(t-2). 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) 0.4y(n-2) = x(n) + 0.5x(n-1) + x(n-2)
- 2C. Evaluate the step response of LTI System with impulse response h(n) = u(n)

(5+3+2)

3A. Find the natural response and forced response of the system described by the differential equation for  $x(t) = e^{-2t}u(t)$ 

$$\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 4 y(t) = x(t) \quad ; \ y(0-) = 0 \text{ and } \frac{dy(0-)}{dt} = 1$$

3B.

Evaluate appropriate Fourier representation and sketch magnitude and phase spectra of (i)  $x(t) = 1 + \cos(2\pi t) + \sin(3\pi t)$ 

3C. Obtain the time domain signal with DTFS as  $X(n) = \cos\left(\frac{6\pi}{17}k\right)$ 

(5+3+2) dy(t)

4A.

A LTI system is described by 
$$\frac{d^2 y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t) - \frac{dy(t)}{dt}$$
. Determine (i) Frequency response

of the system (ii) impulse response of the system

- 4B Determine and sketch the Fourier transform of rectangular pulse of width T
- 4C Find DTFT of  $x(n) = (0.5)^n u(n)$ .

(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  $x(t) = \frac{2\sin(2\pi t)}{\pi t}$  Use Fourier transform to find the output of the filter.
- 5B. Write a note on Fourier Transform representation of periodic continuous time signals.
- 5C. State sampling theorem for band limited signals. Illustrate.

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(4+3+3)