Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

THIRD SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION
NOV/DEC 2015
SUBJECT: SIGNALS AND SYSTEMS (ECE - 2104)

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

Instructions to candidates
- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Consider the input-output relations of three systems as given here: (i) $y(t) = x^2(t) + dx(t)/dt$ and (ii) $y[n] = e^{x[-n]}$ and (iii) $y[n] = 2x[n]+4x[n+1]$. Do these systems possess linearity, causality and time-invariant properties? Justify your answer.

1B. Consider a signal $x(t) = 3t/4$ in the interval $0 < t < 4$ and 0 otherwise. Plot $x(2t)$, $x(2-t)$ and $-2x(t+2)$

1C. Evaluate the energy or power (whichever is relevant) for $x[n]=e^{-n/4}u[n+2]$ and $x(t) = \cos^2(100\pi t)$

(5+3+2)

2A. Evaluate the output of the following systems with impulse responses $h(t) = -u(t-2)-u(t-1)+u(t+1)+u(t+2)$ and $h[n]= n(u[n+2]-u[n-3])$ for inputs $x(t) = e^{-2t}u(t-3)$ and $x[n] = 0.5^n(u[n+2] - u[n-3])$

2B. Derive the conditions to be satisfied by the impulse response of a discrete time system if that system has to be stable, causal and invertible.

2C. Given input-output relation as $y(t) + 2dy(t)/dt - 4d^2y(t)/dt^2 = dx(t)/dt$, draw the direct form 1 and direct form 2 implementation of this system

(5+3+2)

3A. Given $x(t) = e^{-t^2/2}$, determine its Fourier representation. With the help of Fourier representation, evaluate the convolution of $x(t)$ with itself.

3B. Given $X(e^{j\Omega}) = 1$ for $0.1\pi < |\Omega| < 0.3\pi$, and zero otherwise in $-\pi < \Omega < \pi$, compute the inverse Fourier representation of $X(e^{j\Omega})$.

3C. Using ideas from Fourier representation of signals, evaluate $\int_{-\infty}^{\infty} \cos(\omega_0 t)dt$

(5+3+2)

4A. An LTI system has impulse response $h(t) = \text{sinc}(3t)$. Let the input to this system be a periodic square wave defined as $x(t) = 1$ for $-1/2 < t < +1/2$ and zero otherwise for one period. The fundamental period of $x(t)$ is 2 time units. Determine the output $y(t)$ of the system.

4B. Find the Nyquist sampling rate of the signal $x(t) = 10\text{sinc}(5t)$ and plot the spectrum of the sampled signal if it is sampled at the Nyquist rate.

4C. Bring out the relation between Laplace transform and Fourier transform.

(5+3+2)

5A. Given the LTI system description as $12x[n] = -12y[n]+7y[n-1]-y[n-2]$, determine the system function and the impulse response. Plot the poles and zeros.

5B. Given $X(z) = 1/(1-0.25z^{-1})$, determine all possible time domain representations of this transform with support of ROC and its plots.

5C. Describe how the stability and causality of the system can be interpreted from the pole-zero plot of the system function.

(5+3+2)