Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

THIRD SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - NOV/DEC 2016
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. Distinguish between power and energy signals. Categorize the following as power or energy signals and find the energy or power of the signal. (i) $x[n]=\left(\frac{1}{2}\right)^n u[n]$ (ii) $x(t)=\cos^2(\omega_0 t)$. Also sketch the even and odd components of *x[n]* and *x(t)*.

1B. Determine whether the following systems described by the input-output relation are time-invariant or not?

(i) $y(t)=\log\{x(t)\}$ (ii) $y[n]=x[n]\cos(\omega_0 n)$

1C. Determine whether the signal $x(t)=2\cos(t)+3\cos(t/3)$ is periodic or not. If periodic, calculate its period.

(5+3+2)

2A. Suppose that the input *x(t)* and impulse response *h(t)* of a LTI system is given by $x(t)=\begin{cases}2, & -2\le t\le 2\\ 0, & elsewhere\end{cases}$ and $h(t)=\begin{cases}4, & 0\le t\le 2\\ 0, & elsewhere\end{cases}$ respectively. Using convolution, evaluate the output *y(t)* of the LTI system and also sketch the output *y(t)*.

2B. A certain LTI system has impulse response, $h[n]=\left(\frac{3}{4}\right)^n u[n]$. Determine the step response of the system using time-domain convolution.

2C. Obtain the direct form-I and direct form-II implementations for the LTI system defined by, $2y[n]+3y[n-1]-y[n-2]-2x[n-1]+4x[n-2]=0$.

(5+3+2)

3A. The impulse response of a continuous time system is given by, $h(t)=\cos(5\pi t)\frac{\sin(\pi t)}{\pi t}$. Find the output to the input $x(t)=2+\cos(\pi t)-2Sin\left(\frac{5}{2}\pi t\right)-2\cos(6\pi t)$.

3B. Determine the DTFT of the signal, $x[n]=n\left(\frac{1}{2}\right)^n u[n-3]$.

3C. Using properties of FT determine the signal x(t) if its spectrum is $X(j\omega)=\frac{1}{1+\omega^2}$

(5+3+2)

4A. Consider the system shown in Figure Q4A with input signal $x(t)=\cos(\pi t)$. Sketch $X_p(j\omega)$ for (i) T=1/3 and (ii) T=1.

4B. Determine an impulse response of discrete-time causal inverse system to eliminate the effect of echo received along with the signal. The echo is one unit time delayed with strength half of the input signal.

4C. Determine the difference equation of the system that has DTFT, $H(e^{j\Omega})=\frac{1+e^{-j\Omega}}{3+e^{-j2\Omega}}$.

(5+3+2)

5A. Determine the time domain signal corresponding to Z-transfer function,

$$H(z)=\frac{1+\frac{7}{6}z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{3}z^{-1}\right)}$$ if, (i) $|z|>\frac{1}{2}$ ii) $|z|<\frac{1}{3}$ iii) $\frac{1}{3}<|z|<\frac{1}{2}$.

5B. Determine bilateral Z-transform of the rectangular window sequence $x[n]=\begin{cases}1; & 0\le n\le 7\\ 0; & elsewhere\end{cases}$

Plot the poles and zeroes in z-plane and indicate ROC.

5C. Determine the bilateral Laplace Transform and ROC for the signal, $x(t)=\cos(3t)u(t)$.

(5+3+2)

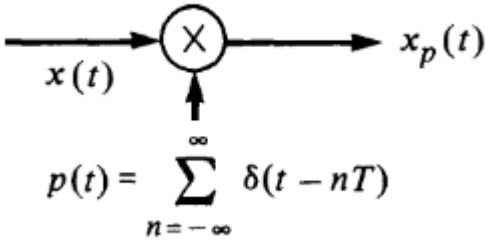

Figure Q4A