Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

THIRD SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION
DEEMBER 2018
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. (i) Express x(t) in terms of g(t) shown in **Fig. Q1A**. Determine total energy of x(t).
(ii) State with justification whether system given below is linear, stable, causal, and Time invariant. $y[n] = x[n]u[n+5]$

1B. Determine the output signal of the system shown in **Fig. Q1B** for an input signal $x(t) = e^{-2|t|}$

(5+5)

2A. (i) Determine step response of a system whose impulse response $h[n] = (1/2)^n u[n+5]$

(ii) Determine energy or average power as applicable for the signal $x[n] = \sin(\frac{\pi}{3}n)\cos(\frac{\pi}{2}n)$

2B. Derive the condition for an LTI system with impulse response h[n] to be:
(a) memoryless (b) causal and (c) stable. Hence State whether the system with impulse response $h[n] = \left(-\frac{1}{4}\right)^n \{u[n+4] - u[n-5]\}$ is memoryless, causal and stable.

(5+5)

3A. (i) Determine the signal x(t), if its FT is given as $X(j\omega) = \frac{1}{j\omega(2+j\omega)} + 3\pi\delta(\omega)$

(ii) Determine the signal that has DTFT $Y(e^{j\Omega}) = \frac{d}{d\Omega}\left\{e^{-j4\Omega}\left[X\left(e^{j(\Omega+\frac{\pi}{4})}\right)\right] + X\left(e^{j(\Omega+\frac{\pi}{4})}\right)\right\}$ if

$x[n] = n\left(\frac{3}{4}\right)^{|n|} \overset{DTFT}{\leftrightarrow} X(e^{j\Omega})$

3B. Obtain and plot the spectrum of y(t) for the system shown in **Fig. Q3B(a)** where $h(t) = \frac{\sin(5\pi t)}{\pi t}$ and $c(t) = cos(5\pi t)$. The input signal x(t) has the spectrum as shown in **Fig. Q3B(b)**

(5+5)

4A. Discrete signal x(n) is obtained by sampling continuous time signal x(t) at proper rate without aliasing.

i) Obtain the frequency response and impulse response of ideal reconstruction filter to reconstruct x(t) from x(n). Highlight the reasons why this is not practically implementable.

ii) What is the impulse response of Zero Order Hold system for practical reconstruction? Obtain and plot the spectrum of the output of such system assuming suitable spectrum for x(t).

4B. The signal $y(t) = e^{-3t}\,u(t)$ is the output of a causal all-pass system for which the system function is H(s) = (s-1)/(s+1). Determine the three possible inputs x(t) that could produce y(t).

(5+5)

5A. Explain the following properties of Z-transform. Mention the effect on ROC in each case.
i) Time shifting ii) Time scaling iii) Time reversal iv) Scaling in **z**-domain v) Differentiating in **z**

5B. If the input to a system is $x(n) = (1/6)^n\,u(n)$, then the output is $y(n) = [10(1/3)^n - 9(1/2)^n]u(n)$. Determine the system function H(z). What is the ROC for H(z)? Is this system stable?

(5+5)

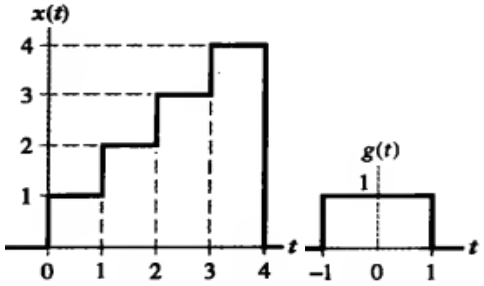

Fig. Q1A

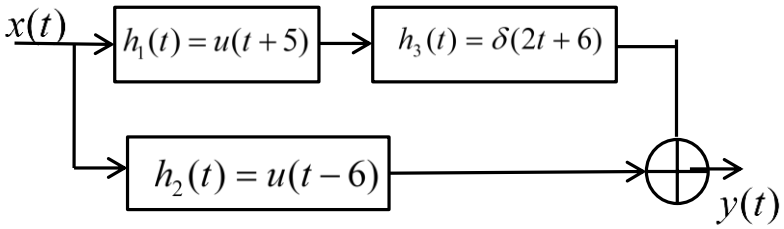

Fig. Q1B

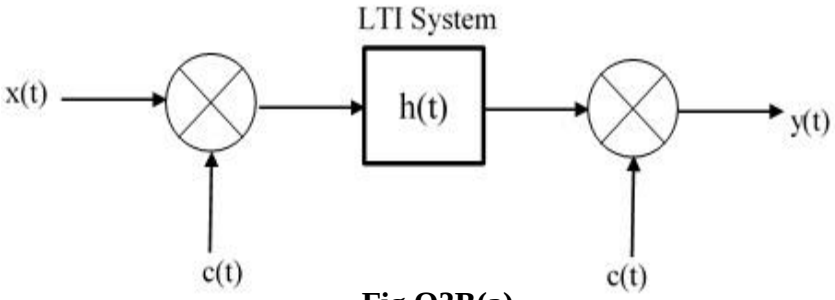

Fig Q3B(a)

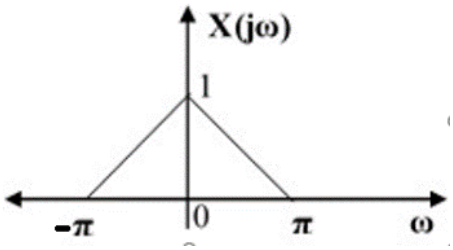

Fig Q3B(b)