Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

THIRD SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION
DECEMBER 2018/JANUARY 2019
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. Express the signal x(t) shown in **Figure 1A** in terms of step and ramp functions. Also determine and plot Odd and Even parts of x(t)

1B. (i) Given $v(t) = \sin(t)u(t)$, state whether the signal $x(t) = v(t) + v(-t)$ is periodic. Justify your statement. Determine period if signal is periodic.

(ii) State with justification whether the discrete time system defined by $y[n] = (-2)^n x[|n|]$ is stable, linear, memoryless, causal, invertible

(5+5)

2A. Derive the condition for the system that has impulse response h(t) to be (a) memoryless, (b) causal, and (c) stable. Hence State whether the system h(t) = (1/4)(u(t) − u(t − 4)) is stable, causal and memoryless.

2B. (i) Find the step response of a system defined by impulse response $h(t) = e^{-3|t|}$

(ii) Draw DF I and DF II for the system defined by differential equation

$$\frac{d^3y(t)}{dt^3} + 5\frac{d\ y(t)}{dt} + 6y(t) = \frac{d^2x(t)}{dt^2} + \frac{d\ x(t)}{dt}$$

(5+5)

3A. Determine appropriate Fourier representation of signal $x[n] = 2 + \cos(\frac{\pi}{3}n)$ and plot magnitude and phase function. Compute energy and power as applicable.

3B. Using Fourier analysis, determine the output of the LTI system with impulse response: $h(t) = 2\cos(2\pi t)\frac{\sin(\pi t)}{\pi t}$ to the input x (t) = 0.5 + cos(1.5πt) + cos (6π t)

(5+5)

4A. Explain the process of sampling analog signal. Derive the expression for Fourier transform of the sampled signal and hence illustrate sampling theorem through suitable spectral plots.

4B. Determine the bilateral Laplace transform of the signal x(t) = e^{-3t} u(t) + e^{-t} cos(2t) u(t). Plot the poles and zeroes and indicate ROC.

(5+5)

5A. State and prove linearity and convolution properties of Z-transform. Discuss the effect on ROC with example.

5B. Consider the z-transform $X(z) = \frac{\left(3-\frac{5}{6}z^{-1}\right)}{\left(1-\frac{1}{4}z^{-1}\right)\left(1-\frac{1}{3}z^{-1}\right)}$

Determine the three time domain signals corresponding to this z-transform.

(5+5)

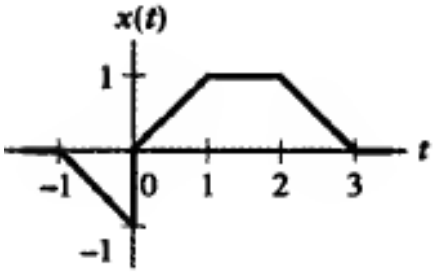

Figure. 1A