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# MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

## IVSEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
## END SEMESTER EXAMINATIONS, APRIL / MAY 2019

## SIGNALS AND SYSTEMS [ELE 2201]
REVISED CREDIT SYSTEM

**Time: 3 Hours** **26 APRIL 2019** **Max. Marks: 50**

**Instructions to Candidates:**

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Table of Transform may be used.

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**1A.** Check whether each of the following time signals is periodic. If periodic determine the fundamental period.

i. $x(n) = 1 + e^{\frac{j4\pi n}{7}} - e^{\frac{-j2\pi n}{5}}$

ii. $x(n) = 3e^{\frac{j3(n+\frac{1}{2})}{5}}$

iii. $x(t) = e^{(-1+j)t}$ ***(03)***

**1B.** Determine whether the following signals are energy or power signals. Also determine the energy and power of the signals.

i. $x(t) = e^{-2|t|}$

ii. $x(n) = 3e^{j\left(\frac{\pi n}{2}+\frac{\pi}{6}\right)}$ ***(03)***

**1C.** A continuous time signal $x(t)$ is defined as:

$$x(t) = \begin{cases} -(t+1); & -1 \le t \le 0 \\ t; & 0 \le t \le 1 \\ 1; & 1 \le t \le 2 \\ -(t-3); & 2 \le t \le 3 \end{cases}$$

Sketch

i. $x\left(\frac{-2t}{5} + \frac{1}{3}\right)$

ii. $x(-2t-2)$ ***(04)***

**2A.** Determine whether the system represented by the following input-output relations are (a) linear (b) time invariant

i. $y(n) = x(2n)$

ii. $y(t) = tx(t)$ ***(03)***

**2B.** Two causal LTI systems with unit sample responses $h_1(n)$ and $h_2(n)$ are connected as shown in Fig. Q2B. If the input $x(n) = [\mathbf{1}, \quad 1]$ and $h_2(n) = \delta(n) - \delta(n-2)$, the output from the system is $y(n) = [\mathbf{2}, \quad 4, \quad 2]$ compute $h_1(n)$. ***(03)***

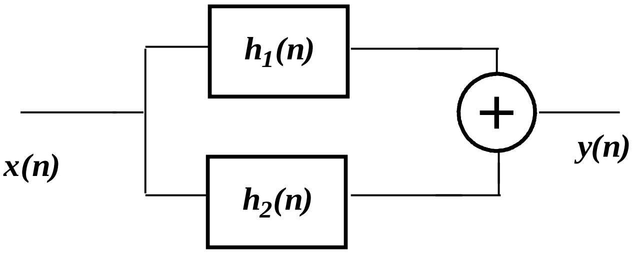


*Fig Q2B*

**2C.** Evaluate $y(t) = x_1(t) * x_2(t)$ if $x_1(t) = u(t+1) - u(t-1)$ and $x_2(t) = u(t+2) - 2u(t) + u(t-2)$ ***(04)***

**3A.** Find the Exponential Fourier coefficient of the waveform shown in Figure Q3A.

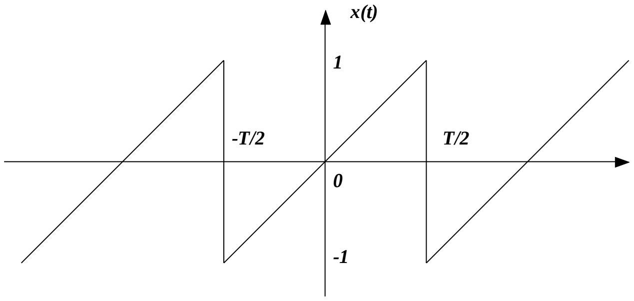


*Fig. Q3A* ***(03)***

**3B.** Find the Fourier transform of the continuous-time signal $x(t)$ using properties.
$x(t) = \frac{d}{dt}\left\{te^{(-3t)}u(t-2)\right\}$ ***(03)***

**3C.** Find the forced response of linear time invariant discrete time system described by difference equation $y(n) + \frac{8}{15}y(n-1) + \frac{1}{15}y(n-2) = x(n) + x(n+1)$. Given $y(-1) = y(-2) = 1$ and $x(n) = \left(\frac{-1}{3}\right)^n u(n)$ ***(04)***

**4A.** Using the defining equation determine DTFS coefficient $X(k)$ for signal
$x(n) = 2 + cos\left(\frac{6\pi n}{13} + \frac{\pi}{6}\right)$. Also plot magnitude and phase spectra. ***(03)***

**4B.** If the DTFT of $x(n) = X(e^{j\Omega})$ Prove that DTFT of $nx(n) = \frac{jd}{d\Omega}\left(X(e^{j\Omega})\right)$ ***(03)***

**4C.** If the DTFT of $x(n) = n\left(\frac{-5}{3}\right)^n u(n)$ is $X(e^{j\Omega})$, without evaluating $X(e^{j\Omega})$, find $y(n)$ in each of the following.

i. $Y(e^{j\Omega}) = e^{-j3\Omega}X(e^{j\Omega})$

ii. $Y(e^{j\Omega}) = \frac{d}{d\Omega}\left\{e^{-j3\Omega}\left[X\left[e^{j\left(\Omega+\frac{\pi}{6}\right)}\right] - X\left[e^{j\left(\Omega-\frac{\pi}{6}\right)}\right]\right]\right\}$ ***(04)***

**5A.** The impulse response of a discrete time LTI system is given by
$h(n) = \left(\frac{1}{2}\right)^n u(n) + \left(-\frac{1}{3}\right)^n u(n)$. Find the z transform of $h(n)$ and its ROC. Also find the location of poles and zeros. ***(03)***

**5B.** Find the z transform of the sequence $x(n) = n\left(\frac{1}{2}\right)^{|n|}$ ***(03)***

**5C.** Find the impulse response of the system if $x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$ and $y(n) = \delta(n) - \frac{3}{4}\delta(n-1)$. Use z transform tool. ***(04)***