



Time: 1 Hour

*Sessional-2 Examination, 2019-20*

**Maximum Marks: 15**  
Weightage: 100 %

Important instructions:

- All questions are compulsory and carry marks as indicated.

1. Find out the Fourier transforms of the following signals [**CO3,2+1.5+2=5.5**]

(a)  $x(t) = \sum_{n=-\infty}^{\infty} \delta(t - 4n)$ . Plot the magnitude and phase of Fourier transform with frequency.

(b)  $x(t) = \exp(-3|t|) \sin(2t)$

2. Assume  $x(t)$  and  $y(t)$  be the input signal and impulse response of an LTI system. Find out the output signal  $y(t)$  for the following choices of  $x(t)$  and  $h(t)$  using Fourier transform properties [**CO3,2**]

$$x(t) = t \exp(-2t) \quad \text{and} \quad h(t) = t \exp(-4t)$$

3. Suppose you have the following information about a signal  $x(t)$  [**CO2, 6**]

(a)  $x(t)$  is real

(b)  $x(t)$  is periodic with period  $T = 6$  and has Fourier series coefficients  $X_n$ .

(c)  $X_n = 0$  for  $n = 0$  and  $n > 2$ .

(d)  $x(t) = -x(t - 3)$

(e)  $\frac{1}{6} \int_{-3}^{+3} |x(t)|^2 dt = \frac{1}{2}$ .

(f)  $X_1$  is positive real number.

Show that the signal  $x(t)$  can be represented in form  $A \cos(Bt + C)$ , and determine  $A$ ,  $B$  and  $C$ .

4. Determine the Fourier series coefficients of the signal

$$x[n] = 1 + \sin\left(\frac{2\pi n}{N}\right) + 3 \cos\left(\frac{2\pi n}{N}\right) + \cos\left(\frac{4\pi n}{N} + \frac{\pi}{2}\right)$$

[**CO2, 1.5**]