PG/IIS/ELC/202/23

M.Sc. 2nd Semester Examination, 2023

ELECTRONICS

(Signals and Systems)

PAPER – ELC-202

Full Marks : 50

Time : 2 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

1. Answer any *four* questions : 2×4

(*a*) What is a deterministic signal ? Give an example. 1 + 1

(*b*) What do you mean by essential bandwidth of a signal ? 2

(*c*) What is aliasing effect ? 2

(*d*) What do you mean by time-invariant system ? 2

(*e*) Establish the relation between the input signal energy spectral density and the output signal energy spectral density. 2

(*f*) What is Fast Fourier Transform (FFT) ? 2

2. Answer any *four* questions : 4×4

(*a*) What is zero padding ? What are its uses ? $2 + 2$

(*b*) Test whether the following systems are causal or non-causal : $2 + 2$

(*i*) $y(n) = ax(n) + bx(n - 1)$

(*ii*) $y(n) = x(n^2)$

(*c*) Explain Overlap-Save method for filtering of long duration sequences. 4

(*d*) Verify Parseval's theorem for the signal $g(t) = e^{-at}\, u(t)$ for $a > 0$. 4

(*e*) Find the circular convolution of two finite duration sequences $x_1(n) = \{1, 1, -2, 3, -1\}$ and $x_2(n) = \{1, 2, 3\}$. 4

(*f*) (*i*) What do you mean by auto-correlation and cross-correlation ?

(*ii*) What is radix -2 FFT ? 2 + 2

3. Answer any *two* questions : 8 × 2

(*a*) (*i*) How will you obtain linear convolution from circular convolution for two finite duration sequences ?

(*ii*) Compute the circular convolution of $x_1(n)$ and $x_2(n)$ for $N = 5$ where 8

$$x_1(n) = \delta(n) + \delta(n-1) - \delta(n-2) - \delta(n-3)$$

$$x_2(n) = \delta(n) - \delta(n-2) + \delta(n-4)$$

(*b*) Find the total response of the system described by difference equation

$$y(n) - 4y(n-1) + 4y(n-2) = x(n) - x(n-1)$$

when the input is $x(n(= (-1)^n u(n)$ with the *initial conditions* $y(-1) = y(-2) = 1$. 5 + 3

(*c*) Derive the expression of the Fourier Integral to represent aperiodic signal. 8

(*d*) (*i*) Explain the energy spectral density of a signal.

(*ii*) Estimate the essential bandwidth W rad/s of the signal $e^{-at}u(t)$, if the essential band is required to contain 90% of the signal energy. 4 + 4

[Internal Assessment – 10 Marks]