PG/IVS/ELC/402/24

M.Sc. 4th Semester Examination, 2024

ELECTRONICS

(*Digital Signal Processing*)

PAPER – ELC-402

Full Marks : 50

Time : 2 hours

Answer **all** questions

The figures in the right hand margin indicate marks

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

GROUP – A

Answer any **four** questions : 2×4

1. What do you mean by energy and power signals ? $1 + 1$

2. Test if the system given by
$y(n) = x(n + 1) + 3x(n) + 4x(n - 1)$
is causal or not. 2

3. What are the properties of region of convergence ? 2

4. What do you mean by time-invariant system ? 2

5. What do you mean by radix-2 FFT ? 2

6. Calculate the number of multiplications needed in the calculation of DFT using FFT algorithm with 16-point sequence. 2

GROUP – B

Answer any **four** questions : 4×4

7. Find the input signal $x(n)$ that will generate the output sequence $y(n) = \{1, 1, 2, 0, 1, 2\}$ for a system with impulse response $h(n) = \{1, -1, 1\}$. 4

8. Find the z-transform and region of convergence of the following discrete-time signal. 2 + 2

$$x(n)=\left(-\frac{1}{3}\right)^{n} u(n)+3\left(\frac{1}{2}\right)^{-n} u(-n-1)$$

9. What do you mean by zero-padding ? Mention its uses. 2 + 2

10. 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

11. Write down the magnitude function of Butterworth filter. What is the effect of varying order on magnitude and phase response ? 2 + 2

12. Write a short note on RADAR signal processing. 4

GROUP – C

Answer any **two** questions : 8×2

13. Find the total response of the system described by difference equation
$y(n) - 2y(n-1) + 2y(n-2) = x(n) - x(n-1)$
when the input is $x(n) = (-1)^n u(n)$ with the initial conditions $y(-1) = y(-2) = 1$. 8

14. Determine the 8-point DFT of the sequence
$x(n) = \{1, 1, 1, 1, 1, 0, 0, 0\}$. 8

15. How one can design digital filters from analog filter ? For the given specifications design an analog Butterworth filter :

$0.8 \leq |H(j\Omega)| \leq 1$ for $0 \leq \Omega \leq 0.2\pi$,
$|H(j\Omega)| \leq 0.2$ for $0.4\pi \leq \Omega \leq \pi$. $3 + 5$

16. Discuss the important factors that influence the selection of a digital signal processor for any application. 8

[Internal Assessment – 10 Marks]
