Total No. of printed pages = 3

DIGITAL SIGNAL PROCESSING

Full Marks – 70

Pass Marks – 28

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Define Laplace transform and find the Laplace transform of the following :

    $$2+(4\times2)=10$$

    (i) $e^{-\alpha t}\cos wt$

    (ii) $\cosh wt$

   (b) Find the inverse Laplace transform of

    $$\frac{2s^2-6s+5}{s^3-6s^2+11s-6}$$

    4

2. (a) Prove that if $X(z) = Z\{x(n)\}$, then

    $$Z\{n\,x(n)\} = -Z\,\frac{dX(z)}{dz}$$

    4

(b) Find Z-transform of the signal

$$x(n) = \left(-\frac{1}{5}\right)^n u(n) + \left(\frac{1}{3}\right)^n u(n) \qquad 5$$

(c) Find inverse Z-transform of $\dfrac{1 + \frac{1}{2} z^{-1}}{1 + 3z^{-1} + 2z^{-2}}$

$$5$$

3. Find the DFT of the sample data sequence

$x(n) = \{2, 1, 3, 2, 1, 3\}$ and compute the corresponding amplitude and phase spectrum. 14

4. Define periodic and aperiodic signals. Find whether the following signals are periodic or not.

(a) $u(t) - \dfrac{1}{2}$

(b) $\cos 60\ \pi t + \sin 50\ \pi t$ 4+5+5=14

5. Define and distinguish between power and energy signals. Find whether the following signal is power or energy signal.

$$x(t) = e^{-3t} u(t) \qquad 4+6+4=14$$

6. Define Time-invariant and Time-variant systems. The input output equations for two systems are given below :

(a) $Y(n) = x(n) - x(n-1)$

(b) $Y(n) = x(n) \cos wn$

Determine whether the systems are Time-variant or Time-invariant. $6+(2\times4)=14$

7. Write short notes on any *two* : $7\times2=14$

(a) Causal and non-causal systems

(b) D/A converter

(c) Applications of DSP

(d) BIBO systems.