

Duration – 3 Hours

Total Marks assigned to the paper- 80

- N.B.:-** (1) Question No.1 is compulsory.
 (2) **Attempt** any **three** questions out of remaining **five** questions.
 (3) Assume suitable data if necessary and justify the same.

- Q 1. Answer the following questions. 20
- Define symmetric and anti-symmetric signals.
 - Summarize the properties of ROC.
 - Find the Fourier transform of $x(t) = e^{-2t} \cos 3t u(t)$.
 - List any three properties of DTFT.
- Q 2 a) (i) Write about elementary Continuous time Signals in detail. 10
 (ii) Describe whether the following signal is periodic. If periodic determine the fundamental period.
 $x(t) = 3 \cos(4t) + 2 \sin(\pi t)$
- Q 2 b) Derive the odd and even components of the following signals. 10
 $x(t) = \sin(t) + 2\sin(t) + 2\sin 2(t) \cos(t)$
 $x[n] = \{1, 0, -1, 2, 3\}$
- Q 3 a) (i) Find out the Fourier transform of $x(t) = e^{-at} u(-t)$ 10
 (ii) Determine the Fourier series representation of the signal
 $x(t) = 2 + \cos(4t) + \sin(6t)$
- Q 3 b) Formulate the trigonometric Fourier series over the interval $(-1, 1)$ for the signal 10
 $x(t) = t^2$.
- Q 4 a) (i) Deduce the initial value of $X(z) = \frac{z+2}{(z+1)(z+2)}$ 10
 (ii) Evaluate the Z- transform of $x(n) = (2/3)^n u(n) + (-1/2)^n u(n)$.
- Q 4 b) (i) Infer the Z-transform and ROC of $x[n] = 2^n u(n) + 3^n u(-n-1)$. 10
 (ii) Determine the Z-transform of the sequence $x(n) = \{5, 3, 2, 4\}$.
- Q 5 a) Write short note on (i) properties of DFT (ii) Types of signals 10
 Q 5 b) Determine eight-point DFT of the following sequences using radix-2 DIT-FFT 10
 algorithm $x(n) = \{1, -1, -1, -1, 1, 1, 1, -1\}$.
- Q 6 a) Design a digital Butterworth filter satisfying the constraints using bilinear 10
 transformations.
 $0.707 \leq |H(\omega)| \leq 1.0; 0 \leq \omega \leq \pi/2$
 $|H(\omega)| \leq 0.2; 3\pi/4 \leq \omega \leq \pi$.
- Q 6 b) Design an FIR filter for the ideal frequency response using Hamming window with 10
 $N=7$
 $H_d(\omega) = \{e^{-j2\omega}, -\pi/8 \leq \omega \leq \pi/8$
 $0; \text{ otherwise.}$