G 1409 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2016

Sixth Semester

Branch : Applied Electronics and Instrumentation/Electronics and Communication/ Electronics and Instrumentation Engineering (AI, EC, EI)

AI 010 602/ EC 010 602 and EI 010 602—DIGITAL SIGNAL PROCESSING

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. List out any *four* properties of *z*-transform.
2. Distinguish between minimum and non-minimum phase system.
3. Physically realizable and stable IIR filters cannot have linear phase. Why ?
4. What is frequency warping ?
5. List out any *four* comparison between linear convolution and circular convolution.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Determine the *z*-transform and region of convergence of the sequence.

   (a) $\left(\frac{1}{2}\right)^n u[-n]$.

   (b) $\delta[n+1]$.

7. Determine the frequency response of a system with single zero and pole.

8. Realize $y(n) + y(n+1) + \frac{1}{4} y(n-2) = x(n)$ in cascade form.

Turn over

9. Convert the analog filter with system function $H_a(s)$ into digital filter using impulse invariance method. Assume T = 0.2S.

$$H_a(s) = \frac{16(s+2)}{(s+3)(s^2+2s+5)}.$$

10. Determine the response of the LTI system whose input $x(n)$ and impluse response $h(n)$ are given by :

$x(n) = \{4, 3, 2, 1\}$; $h(n) = \{1, 2, 3, 4\}$.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. Explain the process of changing the sampling rate in the discrete-time operation.

Or

12. What is aliasing ? Explain the reconstruction of a band limited signal from its samples.

13. A discrete-time causal LTI system has the system function.

$$H(z) = \frac{\left(1+0.2z^{-1}\right)\left(1-9z^{-2}\right)}{\left(1+0.81z^{-2}\right)}.$$

(a) Is the system stable.

(b) Find expression for a minimum phase system $H_1(z)$ and an all pass system $H_{ap}(z)$ such that $H(z) = H_1(z)\, H_{ap}(z)$.

Or

14. Explain the properties of minimum phase system.

15. Obtain an analog Chebyshev filter transfer function that satisfies the constraints :

$$\frac{1}{\sqrt{2}} \leq |H(j\Omega)| \leq 1 \; ; \quad 0 \leq \Omega \leq z$$

$$|H(j\Omega)| < 0.1 \; ; \quad \Omega \geq 4.$$

Or

16. A causal linear time invariant system is given by :

$$H(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}}.$$

Draw the signal flow graphs for implementation of the system in each of the forms :

(i) Direct form I.

(ii) Direct form II.

(iii) Cascade of first order systems.

17. Design a Chebyshev low pass filter with the specifications $\alpha_p = 1\,dB$ ripple in the passband $0 \le \omega \le 0.2\,\pi$, $\alpha_s = 15\,dB$ ripple in the stop band $0.3\pi \le \omega \le \pi$ using bilinear transformation.

Or

18. Design a band stop filter to reject frequencies in the range 1 to 2 rad/sec using rectangular window with N = 7.

19. Compute 8 point DFT of : $x(n) = \{2, 2, 2, 2, 1, 1, 1, 1\}$ using radix – 2 DIT FFT.

Or

20. Perform linear convolution of the following sequences by : (i) Overlap add method ; and (ii) Overlap save method.

$x[n] = \{-1, 1, 2, -1, 1, 2, -1, 1, -1\}$ and $h[n] = \{2, 3, -2\}$.

(5 × 12 = 60 marks)