Reg.	No

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

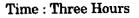
Sixth Semester

Branch: Electrical and Electronics Engineering EE 010 604—DIGITAL SIGNAL PROCESSING

(New Scheme-2010 Admission onwards)

[Regular/Improvement/Supplementary]

Maximum: 100 Marks



Part A

Answer all questions.

Each question carries 3 marks.

1. Check whether the following system is linear or not?

$$y(n) = \frac{x(n-5)+x(n-7)}{x(n-2)x(n-3)}.$$

- 2. Explain the circular shift property of DFT.
- 3. Draw the direct form I structure of a filter whose difference equation is

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1).$$

- 4. Write the equations specifying any three windows used in FIR filter design.
- 5. What is truncation? What is the error that arises due to truncation in floating point numbers?

 $(5 \times 3 = 15 \text{ marks})$

Part B

Answer all questions.

Each question carries 5 marks.

- 6. Find Z-transform of $x(n) = a^n \cos(\Omega_0 n) u(n)$.
- 7. Find the circular convolution of the sequences $x_1(n) = \{2, 1, 2, 1\}, x_2(n) = \{1, 2, 3, 4\}.$
- 8. Explain the forward difference method of converting analog to digital filters.

Turn over

9. Obtain the direct form realisation with minimum number of multipliers:

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

10. Draw and explain the quantizer characteristics with: (a) Round off; and (b) Truncation.

 $(5 \times 5 = 25 \text{ marks})$

Part C

Answer all questions.

Each question carries 12 marks.

11. (a) Solve the difference equation $y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + x(n-1)$, given y(-1) = 2, y(-2) = -1, $x(n) = 2^n u(n)$.

(8 marks)

(b) Specify the Nyquist rate for the following:

(i)
$$g_1(t) = \sin(200 k)$$
.

(ii) $a(s) = (200 s) \cdot \sin^2(200 s)$

(2+2=4 marks)

Or

12. (a) Find the inverse Z-transform of
$$X(Z) = \frac{z^3 - 10z^2 - 4z + 4}{2z^2 - 2z - 4}, |z| < 1.$$
 (8 marks)

- (b) Find the Fourier Transform of $p(t) = \sum_{n=-\infty}^{\infty} \delta(t-n\tau)$, where τ is the fundamental period.

 (4 marks)
- 13. Let $X\left(e^{jw}\right)$ denote the Fourier Transform of the sequence $x(n) = \left(\frac{1}{2}\right)^n u(n)$. Let y(n) denote a finite duration sequence of length 10. ie, y(n) = 0, n < 0 and y(n) = 0, $n \ge 10$. The 10-point DFT of y(n) denoted by Y(k) corresponds to 10 equally spaced samples of $X\left(e^{jw}\right)ie$, $Y[K] = X\left(e^{j2\pi k/10}\right)$. Determine y(n).

Or

14. Compute the 8-point DFT of the sequence $x(n) = \begin{cases} 1 & 0 \le n \le 7 \\ 0 & \text{otherwise} \end{cases}$ using DIT and DIF algorithms.

15. Realise the following system function in parallel form:

$$H(z) = \frac{1 - \frac{2}{3}z^{-1}}{1 - \frac{7}{8}z^{-1} + \frac{3}{32}z^{-2}} + \frac{1 + \frac{7}{4}z^{-1} - \frac{1}{2}z^{-2}}{1 - z^{-1} + \frac{1}{2}z^{-2}}$$



Or

- Design a second order Butterworth digital filter with cut-off frequency 1.2 kHz and sampling frequency of 10⁴ samples/sec by Bilinear Transformation.
- 17. Determine the impulse response h(n) of a filter having desired frequency response

$$\mathbf{H_d}\left(e^{jw}\right) = \begin{cases} e^{-j(N-1) fz, \ 0 \le |w| < \frac{\pi}{2}} \\ e^{0} & \text{for } \frac{\pi}{2} \le w \le \pi \end{cases}$$

where N = 7. Use frequency sampling.

Or

- 18. Design an ideal band pass filter with frequency response $H_d\left(e^{jw}\right)=1$ for $\frac{\pi}{4}\leq |w|\leq \frac{3\pi}{4}$. Use rectangular window with N = 11 in the design.
- 19. Realise the first order transfer function $H(z) = \frac{1}{1 0.5 z^{-1}}$ and draw its quantization noise model. Also find the steady-state noise power due to round off. Take number of bits = 4.

Or

- 20. Discuss the applications of DSP in:
 - (i) Channel vocoder.
 - (ii) Homomorphic vocoder.
 - (iii) Speech processing.

 $(3 \times 4 = 12 \text{ marks})$

 $[5 \times 12 = 60 \text{ marks}]$