D 1223 (Pages : 2) Name.....

Reg. No.....

SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2009

EE 04 702—DIGITAL SIGNAL PROCESSING

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

1. (a) Find the even and odd parts of the given discrete time signal $x[n] = \begin{cases} 1, n \geq 0 \\ 0, n < 0. \end{cases}$

(b) Check whether the system with input $x\ [n]$ and output $y\ [n]$ related by $y[n] = n\left[x\,(n)\right]^2$ is linear and time invariant.

(c) Explain the circular shift property of DFT with example.

(d) What do you mean by bit-reversed sorting ?

(e) Realize the filter transfer function in direct form-I

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

(f) How the speed of operation for computing a program is high in TMS 320 processors than in other processors ?

(g) Using the backward difference for the derivative convert the analog filter with system function

$H(s) = \dfrac{1}{s^2 + 16}$ into digital filter.

(h) Explain the rounding and truncation errors in effects of finite word length in digital filter.

($8 \times 5 = 40$ marks)

2. (a) Find the linear convolution of two sequences given $x\,(n) = \{5, 1, 2, 3, 4\}$ and $h\,(n) = \{1, 1, 2, 3\}$ using graphical method and draw the convolved sequence.

Or

(b) (i) Find the response of the system to the input $x\,(n) = 2^{-n}\,u\,(n)$ and test for its stability.

(10 marks)

(ii) Check whether the system described by $y\,(n) = x\,(n) + 3x\,(n-1)$ is causal and time invariant.

(5 marks)

Turn over

3. (a) Find the impulse response, frequency response, magnitude response and phase response of the 2nd order system

$$y(n) - y(n-1) + \frac{3}{16} y(n-2) = x(n) - \frac{1}{2} x(n-1).$$

Or

(b) Consider an LTI system with impulse response $h(n) = \alpha^n u(n)$ with $|\alpha| < 1$ and input to the system is $x(n) = \beta^n u(n)$ with $|\beta| < 1$. Find $y(n)$ using Fourier transform method.

4. (a) Explain the parameter quantization effects in FIR and IIR filters.

Or

(b) Realize the given transfer function using Direct form I and Direct form II :

$$H(z) = \frac{0.28z^2 + 0.319z + 0.04}{0.5z^2 + 0.3z^2 + 0.17z - 0.2}.$$

5. (a) Design a Chebyshev filter to satisfy the constraints

$$0.707 \le \left|H\left(e^{jw}\right)\right| \le 1, \; 0 \le w \le 0.2\pi$$

$$\left|H\left(e^{jw}\right)\right| \le 0.1, \; 0.5\,\pi \le w \le \pi$$

using impulse invariant method. Assume T = 1 sec.

Or

(b) A filter is to be designed with desired frequence response

$$H_d\left(e^{jw}\right) = \begin{cases} 0, & -\frac{\pi}{4} \le w \le \frac{\pi}{4} \\ e^{-jw}, & \frac{\pi}{4} < w < \pi. \end{cases}$$

Determine the filter coefficients $hd(n)$ if window function is defined by $w(n) = \begin{cases} 1, & 0 \le n \le 4 \\ 0, & \text{otherwise.} \end{cases}$

Also determine the frequency response $H\left(e^{jw}\right)$ of the designed filter.

[4 × 15 = 60 marks]

[redacted]