C 5455 (Pages 2) Name..................................

Reg. No..................................

SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2010

EE 04 702—DIGITAL SIGNAL PROCESSING

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Check whether the system $y(n) = ax(n) - x(n-1)$ is stable or not.

(b) Determine the poles and zeroes of a system described by :

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

(c) Explain linearity property of DFT.

(d) Explain overlap-save method.

(e) How does the parameter quantization affect the pole and zero locations in IIR systems ?

(f) Write a simple program to perform multiplication operation using TMS 320C50 processor.

(g) Why FIR filters are called linear phase filters ?

(h) IIR filters achieve excellent amplitude response. Justify.

(8 × 5 = 40 marks)

II. (a) Consider an input $x(n)$ and unit impulse response $h(n)$ given by :

$x(n) = \alpha^n u(n)$

$h(n) = u(n)$, with $0 < \alpha < 1$.

Find the linear convolution of $x(n)$ and $h(n)$ by Graphical interpretation and draw the output signal.

(15 marks)

Or

(b) (i) Determine the impulse response for the system given by the difference equation :

$$y(n) + 3y(n-1) + 2y(n-2) = 2x(n) - x(n-1).$$

(7 marks)

(ii) Find the response of the system to input $x(n) = u(n)$. Test its stability. (8 marks)

Turn over

III. (a) (i) Find the circular convolution of two sequences $x(n) = \{1, 2, 3, 4\}$ and $h(n) = \{4, 3, 2, 1\}$.

(8 marks)

(ii) Find the Fourier Transform of $f(t) = e^{-at} \cos 6t$. (7 marks)

Or

(b) Determine 8-point DFT for a continuous time signal, $x(t) = \sin(2\pi ft)$ with $f = 50$ Hz using DITFFT.

(15 marks)

IV. (a) Give the lattice structure parameters $k_1 = 1/3, k_2 = 2/5, k_3 = -5/8$, find the equivalent direct-form I IIR structure.

(15 marks)

Or

(b) Briefly explain the architecture of any TMS 320 processor with block diagram. (15 marks)

V. (a) Determine H(z) for a Butterworth filter satisfying the following constraints :

$$\sqrt{0.5} \le \left|H\left(e^{jw}\right)\right| \le 1, \quad 0 \le w \le \pi/2$$

$$\left|H\left(e^{jw}\right)\right| \le 0.2, \; 3\pi/4 \le w \le \pi \quad \text{with}$$

T = 1 sec. Apply impulse invariant transformation.

(15 marks)

Or

(b) (i) A low-pass FIR filter has the desired response as :

$$H_d\left(e^{jw}\right) = \begin{cases} e^{-j3w}, & 0 \le w < \pi/2 \\ 0 \;, & \pi/2 \le w \le \pi \end{cases}$$

Determine the filter coefficients $h(n)$ for M = 7 using type I frequency sampling technique.

(10 marks)

(ii) Explain Hamming window function and obtain the spectrum of Hamming window.

(5 marks)

[4 × 15 = 60 marks]