Reg. No. :

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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fourth Semester

Electrical and Electronics Engineering

EE 6403 — DISCRETE TIME SYSTEMS AND SIGNAL PROCESSING

(Common to Instrumentation and Control Engineering, Electronics and Instrumentation Engineering

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Given a continuous signal $x(t) = 2\cos 300\pi t$. What is the nyquist rate and fundamental frequency of the signal.

2. Determine $x(n) = u(n)$ is a power signal or an energy signal

3. What is ROC of Z transform? State its properties.

4. State initial and final value theorem of Z transform.

5. Calculate the percentage saving in calculation in a 256 point radix-2 FFT when Compared to direct FFT.

6. State circular frequency shift property of DFT.

7. Define pre-wraping effect? Why it is employed?

8. The impulse response of analog filter is given in figure 1. Let $h(n)=h_a(nT)$ where T=1. Determine the system function

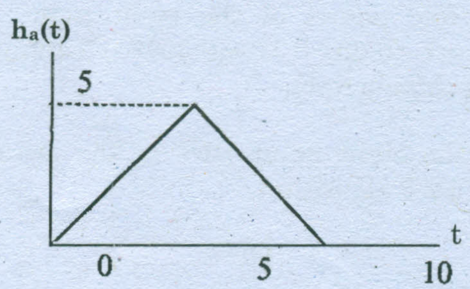

Fig. 1

9. What is the advantage of Harvard Architecture in a DS Processor?

10. How is a DS Processor applicable for motor control applications?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Check the causality and stability of the systems $y(n) = x(-n) + x(n-2) + x(2n-1)$. (8)

(ii) Check the system for linearity and time variance $y(n) = (n-1)x(n) + C$. (8)

Or

(b) (i) What is meant by energy and power signal? Determine whether the following signal are energy or power or neither energy nor power signals.

(1) $x_1(n) = \left(\frac{1}{2}\right)^n u(n)$. (4)

(2) $x_2(n) = \sin\left(\frac{\pi}{6}n\right)$. (4)

(ii) State and prove the Sampling theorem (8)

12. (a) (i) Find the Z transform and ROC of $x(n) = r^n con(n\theta)u(n)$. (8)

(ii) Find the inverse Z transform of $X(z) = \frac{z}{3z2 - 4z + 1}$ ROC$|Z| > 1$. (8)

Or

(b) Using z-transform determine the response y(n) for $n \geq 0$ if $y(n) = \left(\frac{1}{2}\right)y(n-1) + x(n), x(n) = \left(\frac{1}{3}\right)^n u(n)y(-1)$. (16)

13. (a) (i) The first five points of the eight point DFT of a real valued sequence are (0.25, 0,125-j0.3018,0,0.125-j0.0518. Determine the remaining three points (4)

(ii) Compute the eight point DFT of the sequence x={0,1,2,3,4,5,6,7} using DIF FFT algorithm (12)

Or

(b) (i) Find the inverse DFT of

$$X(K) = \{7, -\sqrt{2} - j\sqrt{2}, -j, \sqrt{2} - j\sqrt{2}, 1, \sqrt{2} + j\sqrt{2}, j, -\sqrt{2} + j\sqrt{2}\}.$$ (12)

(ii) Using FFT algorithm compute the DFT of $x(n) = \{2,2,2,2\}$ (4)

14. (a) Design a Butterworth filter using the Impulse invariance method for the following specifications. (16)

$$0.8 \le |H(e^{jw})| \le 1 \qquad 0 \le \omega \le 0.2\pi$$

$$|H(e^{jw})| \le 0.2 \qquad 0.6\pi \le \omega \le \pi$$

Or

(b) Design a filter with desired frequency response.

$$Hd(e^{jw}) = e^{-j3w} \quad for \ \frac{-3\pi}{4} \le \omega \le \frac{3\pi}{4}$$

$$= 0 \quad for \ \frac{3\pi}{4} \le |\omega| \le \pi$$

Using a Hanning window for N=7. (16)

15. (a) Explain the various addressing modes of a commercial DSP processor. (16)

Or

(b) With Suitable block diagram explain in detail about TMS320C54 DSP Processor and of its memory architecture. (8+8)