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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2015

Electrical & Electronics Engineering

(Stream: Power Control & Drives)

01EE6503: Advanced Signal Processing

Time: 3 hours Max marks: 60

Answer any two full questions from each part.

PART–A (Module I and II)

1 a. Check whether the system described by $y[n] = x[n^2]$ is causal or not. (2)

b. Check whether the given system with impulse response $h[n] = e^{(\frac{n}{2})}u[n-4]$ is stable or not. (2)

c. Find the Z transform and ROC for the following signal. (2)

$$x[n] = 3^{n+1}u[n] - 2\left(\frac{1}{2}\right)^n u[-n-1]$$

d. Find the inverse z transform of (3)

$$X(z) = \frac{z(z+1)}{(z-1)^2\left(z-\frac{1}{2}\right)} \quad ROC: |Z| > 1$$

2 a. Find the response for an LTI system described by (4)

$$y[n] - \frac{3}{2}y[n-1] + \frac{1}{2}y[n-2] = 2x[n] + \frac{3}{2}x[n-1]$$

when initial conditions are y[-1]=0, y[-2]=1 and the input $x[n] = \left(\frac{1}{4}\right)^n u[n]$.

b. Find the linear convolution of the sequences $x[n] = \{1,2,3,3\}$ and $h[n] = \{1,1,1\}$ using DFT. (5)

3 a. Compute the 8 point DFT of the following sequence using radix 2 DIF FFT algorithm. $x[n] = n, \quad 0 \le n \le 7$ (5)

b. State and prove any four properties of DFT. (4)

PART–B (Module III and IV)

4 a. Design a digital Butterworth filter that satisfies the following constraints using bilinear transformation. Assume T=1sec. (7)

$$0.9 \le H_d[e^{jw}] \le 1, \quad 0 \le w \le \frac{\pi}{2}$$

$$|H_d[e^{jw}]| \le 0.2, \quad \frac{3\pi}{4} \le w < \pi$$

b. What are the desirable properties of window used in the design of FIR filter? (2)

5 a. Design an ideal low pass filter with a frequency response (5)

$$H_d[e^{jw}] = 1, \quad |w| \leq \frac{\pi}{2}$$
$$= 0, \ \frac{\pi}{2} \leq |w| < \pi$$

Find the values of $h[n]$ for n=11. Use Fourier series method.

b. Compare the truncation and rounding errors using fixed and floating point representations. (4)

6 a. Explain the characteristics of limit cycle oscillation with respect to the system described by the difference equation: $y[n] = 0.95\, y[n-1] + x[n]$. Determine the dead band. Take number of bits=4, $y[-1] = 0$, and (5)

$$x[n] = 0.875, \quad n = 0$$
$$= 0, \quad otherwise$$

b. Briefly explain the finite register length effects in the realization of digital filters. (4)

PART– C (Module V and VI)

7 a. A signal $x[n]$ is given by $x[n] = \{0,1,2,3,4,5,6,0,1,2,3,4,5, \ldots\ldots\ldots\}$. Obtain the interpolated signal with a factor of 2 and decimated signal with a factor of 2. (6)

b. Explain the need for time frequency analysis. Also discuss about the time distribution and frequency distribution. (6)

8 a. Differentiate between STFT and Wigner distribution. (4)

b. With a neat block diagram, explain the architecture of ADSP2181 digital signal processor. (8)

9 a. Write a note on Interfacing of digital systems with different sampling rates. (4)

b. Briefly explain the addressing modes of TMS 320F240 digital signal processor. (8)
