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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, JUNE/JULY 2018

Branch: ELECTRICAL & ELECTRONICS ENGINEERING

Stream: ***POWER CONTROL & DRIVES***

Course Code & Name: ***01EE6503 ADVANCED SIGNAL PROCESSING***

Answer *any two full* questions from *each* part

Limit answers to the required points.

Max. Marks: 60 Duration: 3 hours

PART A

1. a. Test the time invariance, linearity and causality of the following;

$y(n) = x(n^2)$ (2) $y(n) = x(-n)$ (3) $y(n) = |x(n)|$

(6 marks)

b. Determine the Z transform including the region of convergence for the following:

$$x(n) = \left(\frac{-1}{5}\right)^n u(n) + 5\left(\frac{1}{2}\right)^{-n} u(-n-1)$$ (3 marks)

2. a. State and prove any four properties of DFT. (3 marks)

b. Determine the inverse Z transform of the following:

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

if ROC are (i) $|Z| > 1$ (ii) $|Z| < \frac{1}{3}$ (iii) $\frac{1}{3} < |Z| < 1$

(6 marks)

3. a. Obtain a 8 point DFT of the sequence x(n)={1,2,3,4,4,3,2,1} using radix 2 DIF FFT Algorithm.

(6 marks)

b. Determine the output response y (n) if h (n) ={1,1,1}; x (n) ={1,2,3,1} by circular convolution. (3 marks)

PART B

4. a. The system function of the analog filter is given as:

$H_a(s) = \frac{s+0.1}{(s+0.1)^2+16}$. Obtain the system function of the digital filter using bilinear transformation which is resonant at $w_r = \frac{\pi}{2}$ (6 marks)

b. Briefly explain about product Quantization errors.
(3 marks)

5. a. Design a FIR filter with the desired response:

$$H_d(e^{j\omega}) = e^{-j3\omega}, |\omega| \le \frac{\pi}{4}$$

$$= 0, \frac{\pi}{4} \le |\omega| \le \pi$$

Use Hanning window for the design. (7 marks)

b. Compare FIR with IIR filters. (2 marks)

6. a. Find the effect of quantization on pole locations of the given second order IIR system, when it is realized in direct form I and in cascaded form. Assume a word length of 4 bits through truncation.

$$H(z) = \frac{1}{1-0.9z^{-1}+0.2z^{-2}}$$

(5 marks)

b. Briefly explain about Discrete Fourier Transform Computations. (4 marks)

PART C

7. a. Draw the efficient structures for decimation and interpolation. (6 marks)

   b. Briefly explain the sampling rate conversion by a factor D. (6 marks)

8. a. Explain the architecture of TMSC 240 processor (8 marks)

   b. Explain the need for Time-Frequency analysis. (4 marks)

9. a. Differentiate between STFT and Wigner Distribution, also discuss about its advantages

   (8marks)

   b. Explain any one application of multirate operation. (4 marks)