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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh semester B.Tech examinations (S), September 2020

Course Code: EE407

Course Name: DIGITAL SIGNAL PROCESSING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1 What is the necessity of computing Fast Fourier Transform? Calculate the number of multiplication needed in the calculation of DFT using FFT algorithm with 32 point sequence. (5)

2 Check whether the following transfer function is of linear phase. Justify your answer. $H(z)= (\frac{1}{2} + z^{-1} + \frac{1}{2}z^{-2})(1 + \frac{1}{3}z^{-1} + z^{-2})$ (5)

3 How s-plane is mapped to z-plane using impulse invariant transformation? Comment on the stability of the filter after this transformation. (5)

4 What do you mean by Gibbs phenomenon in connection with FIR filter design. How its effect can be reduced? (5)

5 Explain product quantization error and obtain the quantization noise model for a second order system. (5)

6 What is truncation? What is the error caused due to truncation of a number to b bits? (5)

7 What are the memory and I/O spaces used in TMS320C24x processor? (5)

8 Explain (i) Interrupt flag register (ii) Microstack (iii) Scaling shifters (5)

PART B

Answer any two full questions, each carries 10 marks.

9 Given x(n)={1,2,3,4,4,3,2,1},find X(K) using DIF FFT algorithm. (10)

10 a) How will you compute linear convolution using DFTs? (5)

b) Realize the following system function using minimum number of multipliers: (5)

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

(10)

11 Obtain the direct form II and cascade realization of

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

PART C

Answer any two full questions, each carries 10 marks.

12 (a) Find the order of an analog Butterworth filter that has a -2dB passband attenuation at a frequency of 20rad/sec and atleast -10dB stopband attenuation at 30rad/sec (5)

(b) With the help of neat diagrams, explain frequency warping. How it can be eliminated? (5)

13 a) For the analog transfer function $H(s)=\frac{2}{(s+2)(s+3)}$, determine H(z) using bilinear transformation method for T=1 sec. (5)

b) The desired frequency response of a lowpass filter is given below. (5)

$$H_d(\omega) = \begin{cases} e^{-j3\omega} & \text{for } -\frac{\pi}{4} \le \omega \le \frac{\pi}{4} \\ 0 & \text{for } \frac{\pi}{4} \le |\omega| \le \pi \end{cases}$$

. Obtain the filter coefficients h(n) by using a rectangular window.

14 Using frequency sampling method design an FIR lowpass filter with $\omega_c=\frac{\pi}{4}\ rad/sec$ for N=15. (10)

PART D

Answer any two full questions, each carries 10 marks.

15 Find the effect of coefficient quantization on pole locations of the given IIR system when it is realised in cascade form. Assume a word length of 3 bits excluding sign bit. (10)

$$H(z)=\frac{1}{1-0.8z^{-1}+0.15z^{-2}}$$

16 a) Check whether limit cycle exists for the following first order IIR filter with difference equation $y(n) = x(n) + Q[ay(n-1)]$ if $a = -\frac{1}{3}$ and the input $x(n) = 0.875, n = 0\ and\ x(n) = 0, n \neq 0\ and\ y(-1) = 0$.The data register length is 4 bits including sign bit. Q[.] represents rounding operation. (5)

b) How the instruction sets of TMS320C24x processor are classified? (5)

17 With a functional block diagram, explain the main architectural features of TMS320C24x processor. (10)

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