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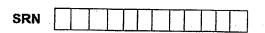
PES University, Bengaluru (Established under Karnataka Act No. 16 of 2013)

UE14EE353

MAY 2017: END SEMESTER ASSESSMENT (ESA) B.TECH. VI SEMESTER **UE14EE353- DIGITAL SIGNAL PROCESSING**

| _ | Time | e: 3 Hrs Answer All Questions Max Marks: 100 | | | | | | |
|----|----------|--|-----|--|--|--|--|--|
| | ····· | | | | | | | |
| 1. | a) | The input sequence x (n) of length 100 is convolved with a unit sample sequence of length 64 using 128-point DFT. Indicate | | | | | | |
| | | I) number of zeros appended if convolution preferred is circular. II) Length of linear convolution and is there an aliasing? | | | | | | |
| | | III) for what index values n circular and linear convolution results are same? | | | | | | |
| | b) | Find the inverse DFT of $Y(k) = X(k) ^2$ where $X(k)$ is the 6 point DFT of | | | | | | |
| | | x(n) = u(n) - u(n-4). | | | | | | |
| | c) | Use known standard DFT's to compute 10 point DFT of | | | | | | |
| | | $x(n) = \delta(n) + \frac{1}{5} + \cos(\frac{3\pi n}{5})$. $0 \le n \le 9$. Also mention any property used. | | | | | | |
| 2. | a) | Give 2 - point DFT computational equation if time and frequency variables are | 06 | | | | | |
| | | independently decimated and show pictorial representation highlighting multiplication and additions involved. | | | | | | |
| | b) | A long input data sequence of length 2000 is to be filtered using impulse sequence of length 250. Suppose a 256 point DFT – IDFT is employed, compute the number of DFT & IDFT recessors by excelor says and excelor add mathematical. | | | | | | |
| | c) | DFT & IDFT necessary by overlap save and overlap add methods. Apply radix – 2 DIT – FFT technique to compute 8 – point DFT of 8 – point circuit | | | | | | |
| | <u> </u> | even real sequence given the first five samples as $x(n) = \{1, 0, 1, 0, 0\}$. | | | | | | |
| 3. | a) | In each of the following filter functions identify the type, order of filter and associated frequencies and magnitude at dc frequency, if applicable. | 06 | | | | | |
| | | i) $H(s) = \frac{s^2 + 100^2}{(s + 100)^2}$ ii) $H(s) = \frac{s}{s + 60}$ | | | | | | |
| | b) | Use examples to prove that angle of separation between poles is a function of filter order in analog Butterworth filter. | 06 | | | | | |
| | c) | Design a low pass analog filter to satisfy the following requirements: | -08 | | | | | |
| | | Monotonic response in pass band and stop band | | | | | | |
| | | -3 dB attenuation in pass band at an edge frequency of 100 rad/s -20 dB stop band attenuation at an edge frequency of 400 rad/s | | | | | | |
| 4. | a) | Realize the filter function given in $(1+z^{-1})^2$ | 06 | | | | | |
| •• | ۳, | Realize the filter function given in adjacent box in direct form 2 & cascaded form with least number of delays. $H(z) = \frac{(1+z^{-1})^2}{(1+\frac{1}{2}z^{-1})(1+\frac{5}{4}z^{-1}+\frac{1}{4}z^{-2})}$ | | | | | | |
| | | form with least number of delays. | | | | | | |

Please turn over



| Γ | b) | Causal digital filter function obtained by Bilinear transformation with $T = 2$ s is | 06 | | | | |
|-----|-----|---|----|--|--|--|--|
| 1 | ", | causar digital inter function obtained by Diffinear transformation with $\Gamma = 2$ s is | | | | | |
| | 1 | $\frac{5z^2+4z-1}{2z^2+4z}$. Determine the parent analog transfer function. | | | | | |
| | | $8z^2 + 4z$ | | | | | |
| • | (s) | Design a first order digital highpass Butterworth filter to satisfy the requirement of -3 | | | | | |
| | | dB ripple in pass band at a cutoff frequency of 3000Hz. Assume 8000Hz as the sampling | | | | | |
| L., | | frequency. Use Bilinear transformation. | | | | | |
| | , | | | | | | |
| 5. | a) | Suggest a suitable window and calculate window length, assuming a transition | 06 | | | | |
| | | frequency of 500 Hz & sampling frequency of 5000 Hz, given: | | | | | |
| | Į | i. Attenuation of near 0 dB in pass band & 70 dB in stop band | | | | | |
| | | ii. Attenuation of near 1 dB in pass band & 25 dB in stop band | | | | | |
| | , | iii. Attenuation of near 0.02 dB in pass band & 55 dB in stop band | | | | | |
| | b) | Find order N & control parameter β of Kaiser window given the frequency specifications: | 06 | | | | |
| | | Cutoff frequency 2200π rad/s | | | | | |
| | | Transition width 900π rad/s | | | | | |
| | | Sampling frequency 12000Hz | | | | | |
| i | | Pass band ripple 0.015dB | | | | | |
| | | Maximum stop band attenuation 50dB. | | | | | |
| | c) | Design a lowpass linear phase FIR filter using Hamming window to satisfy following | 08 | | | | |
| | | requirements: | | | | | |
| | | Passband edge frequency: 1.3 kHz | | | | | |
| | | Stopband edge frequency: 4.5 kHz | | | | | |
| | | | | | | | |
| | | Sampling frequency: 8 kHz. | | | | | |