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PES UNIVERSITY	**PES University, Bangalore** (Established under Karnataka Act 16 of 2013)	**UE15/17 EC302**

END SEMESTER ASSESSMENT (ESA) B. Tech -December2021

UE15/17EC302 – Digital Signal Processing

Time: 3 Hrs | Answer All Questions | Max Marks: 100

1.	a)	Given the sequence x(n)=[1,2,2,1]. Verify this theorem for the given sequence showing the necessary steps involved.	5
	b)	Using 5 point circular convolution compute the output y(n) of FIR filter with impulse response h(n)={1,1,1} for an input sequence x(n)={3,-1,0,1,3,2,0,1,2,1} by a) Overlap save method b) Overlap add method	10
	c)	Consider xp(n) a periodic sequence with fundamental period N. Let X1(k) and X3(k) be N point DFT and 3N point DFT of the sequence xp(n). If X3(k) =X1(k/3)($1+w_3^k+w_3^{2k}$)Verify this for xp(n)=(……1,2,1,2,1,2…) showing the necessary steps involved.	5
2.	a)	Name the 2 FFT algorithms. Compare the number of complex multiplications and additions for DFT and the FFT algorithms with 32- point sequence.	5
	b)	With neat signal flow graphs derive 8 point DIF FFT structure explaining each step. Count the no. of complex additions and multiplications required and compare it with the direct implementation.	10
	c)	Compute DFT of the sequences x1(n)=[4,3,2,1] using DIT FFT.	5
3.	a)	Design a filter with maximally flat response for the given specifications. Max. pass band attenuation of -3db at edge frequency 300 rad/sec. Min. stop band attenuation of -20db at edge frequencies 100 rad/sec.	10
	b)	Get the pole locations and derive the Butterworth Polynomial for a BW filter of order N=3.	5
	c)	Find the order of a Chebyshev filter with pass band tolerance of -3db at 100 rad/sec and stop band attenuation of -25db at 250rad/sec.	5
4.	a)	Let $H(s)=\frac{b}{[s+a]^2+b^2}$ be a causal II order analog transfer function. Derive causal II order digital filter transfer function H(z) in the standard form using IIT.	10
	b)	Obtain a Direct form I and Direct form II realization of the system given by $H(z)=\frac{8z^3-4z^2+11z-2}{[z-1/4][z^2-z+1/2]}$	10
5.	a)	Calculate 'M' for a LP FIR filter using Kaiser window technique with the following specifications. Show the calculation involved. $0.99 \le \lvert H(\omega)\rvert \le 1.01$ 0- ω - 0. 45π rad $0 \le \lvert H(\omega)\rvert \le 0.01$ 0.45π - ω - 0.65π rad	5
	b)	Design a linear phase FIR LP filter with pass band 0-5kHz and sampling frequency 18kHz. M=9. Indicate the point of symmetry.	10
	c)	Mention the windows used for designing FIR filters.	5