SRN | | | | | | | | | | | |

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

UE14/15EE353

DECEMBER 2019: END SEMESTER ASSESSMENT (ESA) B.TECH. VI SEMESTER

UE14/15EE353 - DIGITAL SIGNAL PROCESSING

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

1.	a)	Compute 4 – point DFT $X_1(k)$ and $X_2(k)$ if $x_1(n) = \{1, 2, 3, 4\}$ and $x_2(n) = \{1, 4, 3, 2\}$.	06
	b)	State and prove the following N – point DFT properties i) Circular time reversal ii) Circular frequency shift	06
	c)	Perform graphically circular convolution of sequences $x1(n) = \{3, 2, 1, 0\}$ and $x2(n) = \{1, 2, 3, 0\}$ Also verify by matrix method.	08
2.	a)	Compare the number of operations involved in computing DFT by i) direct evaluation ii) radix -2 algorithm for N = 8.	06
	b)	The impulse response of a system is *{1, 1}*. Suppose the input data is *{1, 1, 3, 3, 5, 5}*, apply overlap – add technique to compute system response. Assume block length as 4.	06
	c)	Use DIT – FFT radix algorithm to evaluate the 8 - point DFT of $x(n) = \{1, 1, 1, 1, 1, 1, 1, 1\}$	08
3.	a)	Mention 3 characteristic each of Butterworth and Chebyshev type 1 analog filters.	06
	b)	Obtain the following filters from a first order filter i) High pass filter to give a cutoff frequency of 100 rad/s ii) Bandpass filter to give bandwidth of 100 rad/s and center frequency of 200 rad/s.	06
	c)	Design a low pass analog Butterworth filter to satisfy the following requirements: • *– 3 dB* attenuation in pass band at an edge frequency of *100 rad/s* • *– 15 dB* stop band attenuation at an edge frequency of *400 rad/s*	08
4.	a)	Write the direct form I & direct form II structures for the LTI system described by: $y(n) = 0.75\,y(n-1) - 0.125\,y(n-2) + 2\,x(n) - x(n-2)$	06
	b)	Derive the mapping equation of impulse invariant technique of converting analog to digital filter and discuss the stability of mapping.	06
	c)	Consider $H(s) = \frac{2}{s^2+3s+2}$. Digitize the analog filter by i) impulse invariant method ii) Bilinear transformation. Assume T =0.2 s.	08
5.	a)	Give the equation of window length and their stopband attenuation used in design of FIR filters.	06
	b)	Design a digital low pass FIR filter using Hamming window given $N = 5$ & $\omega c = 0.5$ *rad*.	06
	c)	Design a lowpass linear phase FIR filter using frequency sampling method having cutoff frequency of $\frac{\pi}{3}$ and N =5.	08