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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Sixth Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; July / Aug. - 2022

Digital Signal Processing

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1 – Apply the knowledge of DFT and FFT in its various applications.
CO2 – Transformation of digital signals into the frequency domain using FFT/DFT methods.
CO3 – Implementation or realization of different digital structures for IIR and FIR systems.
CO4 – Design and Implementation of IIR filters using Bilinear Transformation.
CO5 – Apply the knowledge of DSP Processor and its applications. Thermal energy conversion systems and applications.

***Note: I) PART - A** is compulsory. **Two** marks for each question.*

***II) PART - B**: Answer any **Two** sub questions (from a, b, c) for a Maximum of **18 marks** from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
I a.	State Linearity property.	2	L1	CO1	PO1
b.	List the similarities between DIT and DIF FFT algorithm.	2	L1	CO2	PO1
c.	What are the two types of digital filter?	2	L1	CO3	PO1
d.	What is rectangular window? Explain	2	L1	CO4	PO1
e.	List the application of DSP processors.	2	L1	CO5	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	Find N-point DFT of the following sequences: i) $x(n) = \cos\left(\frac{2\pi}{N}K_0 n\right)$; $0 \le n \le N-1$ ii) $y(n) = \sin\left(\frac{2\pi}{N}K_0 n\right)$; $0 \le n \le N-1$	9	L3	CO1	PO2
b.	State and Prove: i) Circular time shift property ii) Circular frequency property	9	L3	CO1	PO2
c.	Find circular convolution of two given sequence $x_1(n) = \{1, 2, 3, 1\}$ and $x_2(n) = \{4, 3, 2, 2\}$ using time domain approach and using frequency domain approach.	9	L3	CO1	PO2
	UNIT - II	**18**			
2 a.	Develop a DIF FFT algorithm to compute N-point DFT x(K) of an N-Point sequence x(n).	9	L3	CO2	PO3
b.	Given $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$, find x(K) using DIT FFT algorithm.	9	L3	CO2	PO3
c.	Obtain 8-poing DFT of the following sequence using radix-2 DIF FFT algorithm. Show all the result along the signal flow graph, given $x(n) = \{2, 1, 2, 1\}$	9	L3	CO2	PO3

UNIT - III **18**

3 a. Obtain parallel realization for the system described by,

$H(z) = \frac{(1+z^{-1})(1+2z^{-1})}{(1+\frac{1}{2}z^{-1})(1-\frac{1}{4}z^{-1})(1+\frac{1}{8}Z^{-1})}$ 9 L3 CO3 PO3

b. An LTI digital IIR filter is specified by the following TF,

$H(z) = \frac{(z-1)(z-2)(z+1)z}{\left[z-\left(\frac{1}{2}+j\frac{1}{2}\right)\right]\left[z-\left(\frac{1}{2}-\frac{1}{2}j\right)\right]\left[z-\frac{1}{4}j\right]\left[z+\frac{1}{4}j\right]}$ 9 L3 CO3 PO3

Realize the system using the following forms**:**

i) Direct form I ii) Direct form II

c. Obtain the Direct and Cascade form realization of following FIR filter

$H(z) = (1-\frac{1}{4}z^{-1}+\frac{3}{8}z^{-2})\,(1-\frac{1}{8}z^{-1}-\frac{1}{2}z^{-2})$ 9 L3 CO3 PO3

UNIT - IV **18**

4 a. A Butterworth low pass filter has to meet the following specification:

i) Pass band gain k_p = -1 dB, at Ω_p = 4 rad/sec

ii) Stop band attenuation $K_s \geq 20$ dB at Ω_s = 8 rad/sec 9 L3 CO4 PO3

Determine the transfer function of the lowest order Butterworth filter to meet the above specification.

b. The analog filter $H_a(s) = \frac{s+1}{s^2+5s+6}$, find H(z) using impulse invariance transformation take T = 0.1 sec. 9 L3 CO4 PO3

c. Design the symmetric FIR low pass filter whose desired frequency response is given as,

$H_d(\omega) = \begin{cases} e^{-j\omega\tau} \\ 0 \end{cases}$ for $|\omega| \leq \omega_c$ otherwise The length of the filter should be 7. 9 L3 CO4 PO3

and ω_c = 1 radians/sample. Use rectangular window.

UNIT - V **18**

5 a. Explain the architecture of TMS320C5X processor. 9 L2 CO5 PO1

b. With a neat block diagram, explain the following:

i) Servo control using TMS320 processor 9 L2 CO5 PO1

ii) Video signal processing using TMS320Cxx processor

c. List the features of TMS 320 C5x processors. 9 L2 CO5 PO1

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