USN 01JSCT18EC055 Code: EC550

JSS MAHAVIDYAPEETHA
JSS SCIENCE AND TECHNOLOGY UNIVERSITY
SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING
JSS Technical Institutions Campus, Mysuru – 570 006, Karnataka

JANUARY/FEBRUARY 2021 SEMESTER END EXAMINATIONS

PROGRAMME: B.E.	DATE: 29.01.2021
BRANCH: E&C	DAY: Friday
SEMESTER: V	TIME: 9.30 A.M. to 12.30 P.M.
SECTION: 'A' & 'B'	DURATION: 3 hrs.
PAPER SETTER: Smt. B.A. Sujatha Kumari	MAX. MARKS: 100

DIGITAL SIGNAL PROCESSING

NOTE:
1. **Answer all the questions in PART-A**
2. **Questions in PART-B have Internal Choices**

PART – A

Q. No.	CO	CD	QUESTION	MARKS
1.a)	CO1	L2	Define DFT. Obtain the relationship between DFT and Z-transform.	04
b)	CO1	L3	Find N point DFT of the sequence $x(n) = a^n, 0 \le n \le N-1$	03
c)	CO1	L3	Let x(n) be a four point sequence defined as x(n)=δ(n)+2δ(n-2)+δ(n-3). Find 4 point DFT of x(n).	03
2.	CO2	L3	Let x(n)={1,2,0,-3,4,2,-1,1,-2,3,2,1,-3} and h(n)={1,1,1} Find y(n)=x(n)*h(n) using overlap-add method. Verify the result by direct computation.	10
3.a)	CO3	L2	Compare Butterworth and Chebyshev filters.	04
b)	CO3	L2	Derive the expressions for finding order N, cutoff frequency Ω_C and Poles P_K of an analog low pass Butterworth filter.	06
4.a)	CO3	L2	Give a comparison between IIR and FIR filters.	04
b)	CO3	L2	Name any three types of windows used in design of FIR filters. Write their analytical equations and sketch their magnitude response.	06

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5.	CO3	L3	Obtain a) Direct form – I b) Direct form – II c) transposed Direct form – II d) Cascade and e) Parallel realizations for the following IIR System $H(Z)=\frac{8Z^3-4Z^2+11Z-2}{(Z-0.25)(Z^2-Z+0.5)}$	10

PART – B

Q. No.	CO	CD	QUESTION	MARKS
6.a)	CO1	L3	State and prove Parseval's theorem as applied to DFT.	05
b)	CO1	L3	Compute 4 point DFT of the sequence x(n)={1,0,1,0}, find y(n) if Y(k)=X((K-2))$_4$.	05
			OR	
7.a)	CO1	L3	Let $x(n)$ be a real sequence of length N and its N point DFT given by X(k). Show that X*(k)=X(N-k).	04
b)	CO1	L3	Let $x_1(n)$ and $x_2(n)$ be two N point sequences defined as $x_1(n)=C\text{os}\left(\frac{2\pi n}{N}\right) \quad 0\le n\le N-1$ and $x_2(n)=Sin\left(\frac{2\pi n}{N}\right) \quad 0\le n\le N-1$. Find N point circular convolution $x_1(n)*x_2(n)$.	06

8.	CO2	L3	Develop DIT FFT algorithm for computing DFT for N=6=3x2. Draw the complete signal flow graph. Use the signal flow graph to find 6 point DFT of the sequence x(n)={1,2,3,4,5,6}.	10
			OR	
9.	CO2	L3	Develop Radix-2 DIF FFT algorithm for computing N point DFT of a sequence. Draw the signal flow graph for N=8.	10

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10.	CO3	L3	Design a digital Low pass Butterworth filter to meet the following specifications. a) Attenuation in the passband $\leq -1.9328dB$ and Wp=0.2π rad. b) Attenuation in the Stopband $\geq -13.9794dB$ and Ws=0.6π rad. Use Impulse Invariance transform. Assume T = 1Sec.	10
			OR	
11.	CO3	L3	The specifications of a digital Chebyshev filter are as follows. $0.8 \leq \lvert H(w) \rvert \leq 1$ for $0 \leq \omega \leq 0.2\pi$ $\lvert H(W) \rvert \leq 0.2$ for $0.32\pi \leq \omega \leq \pi$ Find H(Z) using Bilinear Transformation. Assume T=2sec.	10

12.	CO3	L3	The desired frequency response of symmetric FIR low pass filter is given by $Hd(\omega) = \begin{cases} e^{-j3w} for \lvert \omega \rvert < \frac{3\pi}{4} \\ 0 for \frac{3\pi}{4} < \lvert \omega \rvert < \pi \end{cases}$ Determine the system function H(Z) of the filter if Hamming Window is used. Also determine the frequency response of the filter,	10
			OR	
13.	CO3	L3	Design a low pass FIR filter using frequency sampling method whose cutoff frequency is $\frac{\pi}{2}$ rad. The filter should have linear phase and length 17.	10

14.a)	CO3	L3	Obtain Linear phase structure for the FIR filter. $h(n) = \delta(n) - \frac{1}{2}\delta(n-1) + \frac{1}{4}\delta(n-2) + \frac{1}{4}\delta(n-3) - \frac{1}{2}\delta(n-4) + \delta(n-5)$	03
b)	CO3	L3	Draw Direct form-I structure for the FIR filter whose Lattice coefficients are K_1=0.65, K2=-0.34 and K_3=0.8	07
			OR	
15.	CO3	L3	Obtain Direct form-I and Lattice structure for the following FIR System. $y(n) = x(n) + \frac{2}{5}x(n-1) + \frac{3}{4}x(n-2) + \frac{1}{3}x(n-3)$	10

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Course Outcomes

CO–1	Perceive discrete-time signals in the frequency domain and its properties, using discrete Fourier transform.
CO–2	Compute DFT using FFT algorithms.
CO–3	Analyse, design and realize digital filters for the given specifications.
CO–4	Implement the applications of Digital Signal Processing algorithms using computer aided tool.

Cognitive Domains:	
L1:	Remember
L2:	Understand
L3:	Apply
L4:	Analyze
L5:	Evaluate
L6:	Create

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