U.S.N

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

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Semester End Examination; Sep. / Oct. - 2023

Signals and DSP

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Apply the knowledge of mathematics to visualize, Classify and perform computation on discrete time signals, systems and properties.

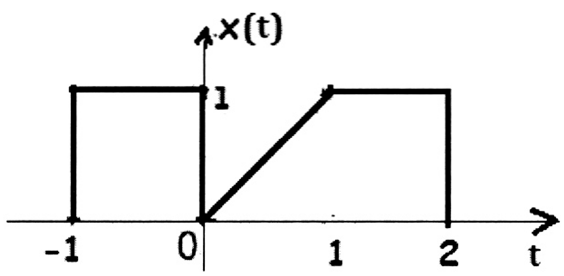
CO2: Analyze both continuous and discrete time systems in time, frequency and z-domains.

CO3: Design simple signal conditioning systems by using different techniques.

CO4: Execute MATLAB program to implement signal operations, processing and filter algorithms.

***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**			
1 a.	Compare energy and power signals.	2	L1	CO1	PO2
b.	Differentiate between casual and non-causal signals.	2	L1	CO1	PO2
c.	Find the inverse DFT of Y(K) ={1, 0, 1, 0}.	2	L1	CO1	PO2
d.	Arrange the 8 point sequence, $x(n) = \{1, 2, 3, 4, -1, -2, 3, -4\}$ in bit reversal order.	2	L2	CO2	PO2
e.	What are the requirements for an analog filter to be stable and causal?	2	L2	CO3	PO2
	II : PART - B	**90**			
	UNIT - I	**18**			
2 a.	Sketch the Even and Odd component of the signal *X(t)* shown below, 	9	L3	CO1	PO2
b.	Determine whether the following signals are periodic or not. If periodic, determine the fundamental period. i) $X(t) = \text{Sin}6\pi t + \text{Cos}5\pi t$ ii) $X[n] = \text{Sin}\left(\frac{2\pi}{3}n\right) + \text{Cos}\left(\frac{\pi}{2}n\right)$	9	L3	CO1	PO2
c.	Determine whether the system described by, i) $y(t) = t^2x(t)$ ii) $y(t) = x(3t)$ Is: Linear or Non-Linear, Time-invariant or Time-Variant, Static or Dynamic and Causal or Non-Causal.	9	L3	CO1	PO2

		Marks	BT	CO	PO
	UNIT - II	**18**			
3 a.	Define two sided Z-transform of a DT signal $X[n]$ and the inverse Z-transform of the signal $X(Z)$. Discuss the properties of ROCs.	9	L2	CO2	PO2
b.	Find the Z-transform of $x(n) = -b^n u(-n-1)$. Find its ROC and plot the same.	9	L3	CO2	PO2
c.	Using partial fraction expansion method, find the discrete-time sequence $x(n)$ which has Z-transform, $X(Z)=\frac{Z(Z^2-4Z+5)}{(Z-3)(Z-2)(Z-1)}$ for; i) ROC $\|Z\| > 3$ ii) ROC $\|Z\| < 1$ iii) ROC $2 < \|Z\| < 3$ iv) ROC $1 < \|Z\| < 2$	9	L3	CO2	PO2
	UNIT - III	**18**			
4 a.	State and prove; i) Linearity Property ii) Circular time shift Property	9	L2	CO2	PO2
b.	Compute the 5 point DFT of the sequence, $x(n) = (1, 0, 1, 0, 1)$.	9	L2	CO2	PO2
c.	Compute 4 point circular convolution of the sequences given by $x(n) = \{2, 3, 1, 1\}$ and $h(n) = \{1, 3, 5, 3\}$ using Stock ham's method.	9	L2	CO2	PO2
	UNIT - IV	**18**			
5 a.	Develop a radix-2 DIF-FFT algorithm for N point DFT.	9	L2	CO2	PO2
b.	Compute the 8 point DFT of the sequence $x(n) =\{1, 2, 3, 4, 4, 3, 2, 1\}$ by DIT-FFT algorithm.	9	L2	CO2	PO2
c.	First five points of the eight point DFT of a real valued sequence is given by $X(0) = 0$, $X(1) = 2+j2$, $X(2) = -j4$, $X(3) = 2-j2$, $X(4) = 0$. Determine the remaining points. Hence find the original sequence $X(n)$ using decimation in frequency FFT algorithm.	9	L2	CO2	PO2
	UNIT - V	**18**			
6 a.	A Butterworth low pass filter has to meet the following specifications: i) Pass band gain, $K_p = -1$ dB at $\Omega_p = 4$ rad/sec. ii) Stop band attenuation greater than or equal to 20dB at $\Omega_s = 8$ rad/sec Determine the transfer function $H_a(s)$ of the lowest order Butterworth filter to meet the above specifications.	9	L2	CO3	PO3
b.	For the analog filter with transfer function $H_a(S) = 4 / (S+2)(S+3)$, determine digital IIR filter transfer function $H(Z)$ using impulse invariant transformation. Assume $T = 2$ sec.	9	L3	CO3	PO3
c.	Derive expression for poles from the squared magnitude response of Butterworth low pass filter.	9	L2	CO2	PO2

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