



PRESIDENCY UNIVERSITY

BENGALURU

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Mid - Term Examinations - March 2026

Date: 13- 03-2026 **Time:**11.45am to 01.15pm

School: SOE	Program: B.Tech		
Course Code: ECE3028	Course Name: - Speech Signal Processing		
Semester: VI	Max Marks: 50	Weightage: 25%	

CO - Levels	C01	C02	C03	C04	C05
Marks	24	22	22	22	

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks.

5Q x 2M=10M

1	Speech signal processing is the study and manipulation of speech signals, focusing on methods for analyzing, synthesizing, and recognizing spoken language. Give one application each of speech recognition and speech synthesis.	2 Marks	L3	C03
2	Consider the following analog speech signals $x_1(t) = \cos 200\pi t$ and $x_2(t) = \cos 50\pi t$. If the signals are sampled at a rate of 40 Hz, write the expressions for the respective discrete time sequences $x_1[n]$ and $x_2[n]$.	2 Marks	L3	C01
3	For the following signal draw $x_1(t + 2)$	2 Marks	L3	C04
4	The Dirac delta function $\delta(t)$ is defined as zero everywhere except at $t = 0$, where it is infinite, and its integral equals one. Express the discrete	2 Marks	L2	C02



	time speech signal $x_1[n] = \{-1, -2, 0, -2, 3, -2\}$ in terms of shifted delta function.			
5	Aliasing is a phenomenon that occurs in signal processing when a continuous signal is sampled at a frequency that is too low to accurately represent the original signal. Consider the analog speech signal $x_1(t) = 3 \cos 250\pi t + 2 \cos 200\pi t$. Determine the minimum sampling rate required to avoid aliasing.	2 Marks	L2	CO1

Part B

Answer the Questions.

Total Marks 40M

6.	a.	Discrete-time signal operations are used to analyze speech signals represented for signal processing. For the following discrete time speech signal $x_1[n] = \{1, 2, 3, 0, -3, -2, -1\}$ <p style="text-align: center;">↑</p> Draw $x_1[n], x_1[n+1], x_1[n/2]$	10 Marks	L3	CO1
	b.	Also draw $x_1[-\frac{1}{2}n+1]$.	10 Marks	L3	CO1
Or					
7.	a.	Consider the analog speech signal $x_1(t) = 2 \cos 150\pi t$ (a) Determine the minimum sampling rate required to avoid aliasing. (b) Suppose that the signal is sampled at the rate $F_s = 250$ Hz. What is the discrete-time signal obtained after sampling?	10 Marks	L3	CO2
	b.	Suppose that the signal in part (a) is sampled at the rate $F_s = 65$ Hz. What is the discrete time signal obtained after sampling?	10 Marks	L2	CO2
8.	a.	Determine the response $y(n), n > 0$, of the system described by the second-order difference equation $y(n) - 3y(n-1) - 4y(n-2) = x(n) + 2x(n-1)$ when the input sequence is $x(n) = 4^n u(n)$, for $y(-2)=0, y(-1)=5$	10 Marks	L3	CO3
	b.	Find the homogeneous and particular solutions of the above second-order difference equation of the filter system.	10 Marks	L3	CO3
Or					
9.	a.	If a discrete time speech signal $x[n] = \{-5, 1, 5\}$ passes through a filter <p style="text-align: center;">↑</p> with impulse response $h[n] = \{-2, 1, -2\}$, find the output of the filter <p style="text-align: center;">↑</p>	10 Marks	L3	CO4
	b.	Also verify the output of the filter $y[n]$ using tabular method.	10 Marks	L3	CO4