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Mid Term Examinations - October 2026

Date: 05/10/2026 **Time:** 02:00 PM - 03:30 PM

Course Code: ECE3400 **Course Name:** Speech Signal Processing

Semester: Fifth Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2	CO3
Marks	22	34	34

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	A sample of a signal is the specific amplitude or value of a continuous-time signal captured at one particular point in time. How many samples will be there within a 30ms signal ?	2	CO2	BT1
2	A Linear Time-Invariant (LTI) model is a mathematical representation of a system where the output is directly proportional and additive to the input (linearity), and the system's behavior does not change over time (time-invariance). Explain the LTI model of speech production with the help of an appropriate block diagram.	2	CO1	BT1
3	A window function performs a calculation across a set of table rows that are related to the current row without collapsing the rows into a single group. Analyze the key factors involved in selecting a suitable window function for a specific signal processing application.	2	CO2	BT4
4	In signal processing and statistics, a window function is a mathematical function that is zero-valued outside of some chosen interval. Analyze the difference between spectral leakage and the smearing effect in a windowed signal.	2	CO3	BT4
5	Short-time energy is a fundamental metric in signal processing and audio analysis that measures the signal's loudness or intensity within a specific, short time frame. Analyze how short-time energy can be used to distinguish speech and nonspeech regions in a speech signal.	2	CO3	BT4

PART B : Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT
6	Affricate sounds are hybrid consonants that start with a complete blockage of airflow (a stop) and release into a turbulent stream of air through a narrow passage (a fricative). Explain how affricate sounds are produced and describe the characteristics of semivowels. Differentiate affricates from stops and fricatives, and semivowels from vowels, giving suitable examples.	10	CO1	BT1
7	Speech signal processing is the method of converting, analyzing, and manipulating spoken words into digital data that computers can understand and use. Explain the characteristics of diphthongs and differentiate them from monophthongs with suitable examples.	10	CO1	BT1

PART C: Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT

8	Analyze, using a suitable numerical example, why Short-Time Energy (STE) gives greater importance to large-amplitude speech samples than Short-Time Average Magnitude (STAM). Calculate both measures and compare their sensitivity to a large-amplitude sample.	10	CO2	BT4
9	A speech-processing system analyzes a frame containing x(n)=[0.25,0.50,0.15,0.75]. Apply the Short-Time Energy and Short-Time Average Magnitude measures to calculate their values. Identify which measure is more sensitive to the strong speech peak and justify your answer.	10	CO2	BT3

PART D: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
10	A speech-processing system analyzes two frames, x1(n) = [0.05, 0.10, 0.15, 0.75] and x2(n) = [0.2,0.25, 0.3, 0.35]. Apply the Short-Time Energy (STE) measure to both frames and determine which frame has higher energy.	10	CO2	BT3
11	Analyze the role of Zero-Crossing Rate (ZCR) in speech signal analysis. Explain how ZCR varies for voiced, unvoiced, and silence regions, with suitable examples.	10	CO3	BT4

PART E: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
12	Analyze the use of the Average Magnitude Difference Function (AMDF) for pitch period estimation in voiced speech. Explain how the minimum of the AMDF indicates the pitch period and relate it to the fundamental frequency with a suitable example.	10	CO3	BT4
13	Analyze how the autocorrelation method can be used to estimate the pitch period of a voiced speech signal. Explain the relationship between the autocorrelation peaks and the fundamental frequency with a suitable example.	10	CO3	BT4