

(3 hours)

[Total Marks: 80]

Note the following instructions.

- (a) Question No. 1 is compulsory.
- (b) In all four questions to be attempted.
- (c) Figures to right indicate full marks.

1. a Describe the sequence of events leading to auditory nerve spiking when acoustic pressure wave appears on the outer ear. [5]
1. b What is vowel triangle? [5]
1. c Draw the block diagram for a typical text to speech system (TTS) and explain the function of each block. [5]
1. d Explain with related equation
 - a. Short-Time Energy [5]
 - b. Short-Time Zero-Crossing Rate [5]
2. a Explain how short time energy (STE) and short time magnitude (STM) can be used to distinguish voiced, unvoiced and silence regions of a speech signal. [8]
2. b Classify the speech sound units. Explain how the speech organs are shaped for speaking the respective speech units. [8]
2. c Explain pitch period estimation using short-time autocorrelation. [4]
3. a Explain evaluation of formants using log spectrum for voiced and unvoiced speech segment. [10]
3. b Draw and explain the discrete-time model of vocal tract and the discrete time radiation model of speech production in detail. [10]
4. a With the help of a block diagram explain how MFCC coefficients are obtained. [8]
4. b What is perceptual linear prediction (PLP)? Compare the procedure to calculate MFCC to that of PLP. [7]
4. c Explain pitch period measurement using cepstral domain. [5]
4. a How do channel vocoders model the vocal tract? [5]
4. b What is difference between RELP and VELP? [7]
4. c What is CELP? How is code book generated for CELP? What are limitation of CELP? What are modifications suggested in the basic CELP coder? [8]
5. a Write the state of art of speech recognition. [7]
5. b What is purpose of Dynamic Time Warping (DTW) algorithm? State the restriction imposed on the optimal warping path [5]
5. c Explain speech recognition using HMM [8]