

Speech Processing / 2.12.16

Q.P. Code : 722900

(3 Hours)



[Total Marks : 80

- N.B. :** (1) Question No.1 is **compulsory**.
(2) Attempt any **Three** from the remaining **Five** questions.
(3) Figures to right indicate **full** marks

1. (a) Explain in detail the human hearing mechanism with suitable diagrams. 5
(b) Explain the procedure for computation of pitch and formants based on cepstral analysis of speech. 5
(c) State and explain the applications of LPC to speech processing. 5
(d) Draw the block schematic for a text-to-speech synthesis system and explain the functions of each block. 5
2. (a) Explain linear filtering interpretation of short-time spectrum analysis with suitable block diagram. 7
(b) With a neat block diagram, explain non-linear smoother for estimation of parameters in speech processing. Justify the need for delays in non-linear smoother. 8
(c) Explain general discrete-time model for speech production. 5
3. (a) With related equations explain the terms (i) Short-time energy 7
(ii) Short-time average magnitude and (iii) Short-time zero crossing rate. How do you distinguish voiced and unvoiced segments based on these parameters?
(b) Explain pitch estimation based on FFT analysis of speech signal. 8
(c) Write a note on production of semivowels and nasals. Give the reason of broadening of nasal resonances. 5
4. (a) Draw a diagram of a single-stage lattice and write the equations for the lattice. 5
(b) Explain the covariance method for LPC analysis. 5
(c) What is CELP? How is the code book generated for CELP? What are the limitations of CELP? What are the modifications suggested in the basic CELP coder? 10

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5. (a) How will you convert power spectrum to mel scale? Explain the procedure for calculation of MFCC with a block schematic. Clearly explain how the integration of power is done on mel scale filters. How will you compress the amplitude of the power spectrum? How is spectral smoothing done? **10**
- (b) Write a detailed note on place and manner of articulation. **10**
6. (a) Explain the terms "liftering" and "quefreny" in connection with cepstral analysis of speech signal. **5**
- (b) What is HMM? What is hidden in it? Draw a state diagram for HMM as a general case and show how you can write a transition matrix. **10**
- (c) Explain speech synthesis using phone-based synthesizer. **5**