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15EC832

## Eighth Semester B.E. Degree Examination, June/July 2019 Speech Processing

Time: 3 hrs.

Max. Marks: 80

**Note: Answer any FIVE full questions, choosing  
ONE full question from each module.**

### Module-1

- 1 a. With a schematic diagram of vocal apparatus, explain the mechanism of speech production. (08 Marks)
- b. With a neat block diagram, explain the acoustic theory of speech production. (08 Marks)

**OR**

- 2 a. Briefly explain lossless tube model of the vocal tract. (08 Marks)
- b. With a neat block diagram, explain digital models for sampled speech signals. (08 Marks)

### Module-2

- 3 a. Briefly explain how short-time energy and average magnitude of speech signal is computed. (08 Marks)
- b. With the related equations and block diagram, explain short-time average zero crossing rate in detail. (08 Marks)

**OR**

- 4 a. From the basic equation for autocorrelation function of discrete –time deterministic signal  $\phi(k)$ , derive the equation for short-time auto–correlation function  $R_n(k)$ . Draw the related block diagram so as to obtain  $R_n(k)$  from the sequence  $x(n)$ . (08 Marks)
- b. Explain how to distinguish speech and silence, using energy and zero crossing. (08 Marks)

### Module-3

- 5 a. Define short-time Fourier transform. explain the Fourier transform interpretation of STFT. (08 Marks)
- b. Explain filter bank summation implementation using FFT. (08 Marks)

**OR**

- 6 a. Explain overlap addition method for short-time synthesis. (08 Marks)
- b. Explain spectrographic analysis of speech signal. What are the typical values of parameters for wideband and narrowband spectrograms? (08 Marks)

### Module-4

- 7 a. Explain the homomorphic system for convolution with related equation and block diagram. (08 Marks)
- b. Discuss the properties of complex cepstrum of stable sequence. (08 Marks)

**OR**

- 8 a. Briefly explain how short-time cepstrum and complex cepstrum of speech is computed. (08 Marks)
- b. Explain homomorphic filtering of natural speech. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.



**Module-5**

- 9 a. Explain the frequency domain interpretations of linear predictive analysis. (08 Marks)  
b. Explain the properties of LPC polynomial  $A(Z)$ . (08 Marks)

**OR**

- 10 a. Discuss the relation of linear predictive analysis to lossless tube models. (08 Marks)  
b. Define :  
i) Computation of the gain for the model  
ii) Prediction error signal. (08 Marks)

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