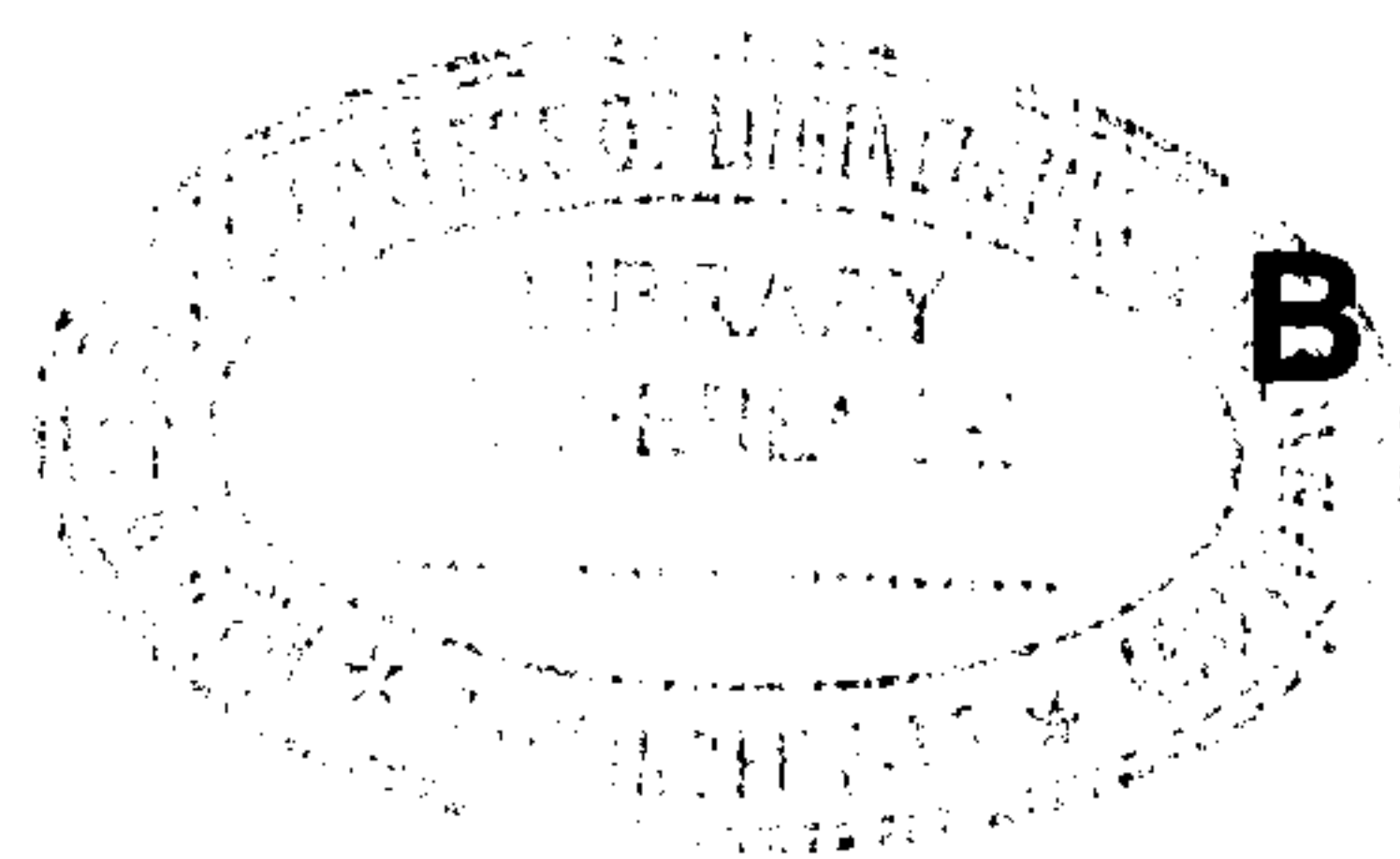




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B – 2917

Reg. No. :

Name :

**Second Semester M.Tech. Degree Examination, December 2016
(2013 Scheme)
ELECTRONICS AND COMMUNICATION ENGINEERING
TSE 2001 : Speech Signal Processing**

Time : 3 Hours

Max. Marks : 60

Instruction : Answer any two questions from each Module.

MODULE – I

1. a) Explain the uniform tube model of speech production. How will you account for nasal sounds in this model ? 5
- b) Define Cepstrum and complex Cepstrum of a discrete signal $x[n]$. Derive the relationship between Cepstrum and complex Cepstrum. 5
2. a) With examples, differentiate the following classes of speech sounds.
i) Fricatives ii) Plosives
iii) Stop consonants iv) Diphthongs. 5
- b) Explain how can we distinguish voiced and unvoiced sounds using time domain analysis parameters such as short time energy, zero crossing rate and autocorrelation function. 5
3. a) Show that Short Time Fourier Transform (STFT) is invertible up to a constant. 5
- b) Differentiate between wide band spectrogram and narrow band spectrogram. Also give applications of narrow band spectrogram and wide band spectrogram in speech analysis. 5

MODULE – II

4. a) Derive the expressions for computing LPC coefficients recursively from the speech segment $x[n]$ using autocorrelation method. 7
- b) Discuss the perceptual relevance of Mel spectrum in speech analysis. 3

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5. a) Define LSF representation of speech segment $x[n]$. Enlist the properties of LSF coefficients. What are the advantages of LSF representation over LPC representation in the case of speech analysis ? 6
- b) Explain Gaussian Mixture Model (GMM) of speech. 4
6. a) Explain the parameter estimation methods used for sinusoidal model of speech. In the context of sinusoidal model, how will you accommodate unvoiced segments of speech ? 7
- b) Explain LPC spectrum of speech. How will you estimate formant frequencies from LPC spectrum ? 3

MODULE – III

7. a) Explain CELP based speech coder. 5
- b) Explain the spectral substitution based speech enhancement algorithm. 5
8. a) What are the different distance measures used for feature discrimination in speech recognition ? 3
- b) Explain sub-band coding of speech. Why we prefer non uniform filter banks in speech coding ? 7
9. a) Explain the HMM based isolated word recognition system. 5
- b) Explain the waveform concatenation based text-to-speech system. 5

