Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013

Subject code: 1724105 Date: 05-06-2013

Subject Name: Speech Signal Processing and Applications

Time: 10.30 am – 01.00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** What is a spectrogram? How is it different from spectrum? Which information about speech waveform can be predicted by seeing spectrogram? **07**

(b) Discuss the effect windowing in Fourier Transform by considering signal which is addition of two cosine waves. Also state why rectangular window is not preferred. **07**

Q.2 **(a)** Explain the classification of phonemes based on manner of articulation by giving its example. **07**

(b) Explain source filter model for speech production. **07**

OR

(b) For pitch detection, Explain the method for speech signal to make the periodicity more prominent and to suppress other distracting features? **07**

Q.3 **(a)** Specify voicing and manner of articulation for the letter in underlined for each of the word given below: **07**
Sing, Scene, Cheap, Van

(b) Explain the algorithm to detect END points of given speech signal using ZCR and short time energy. **07**

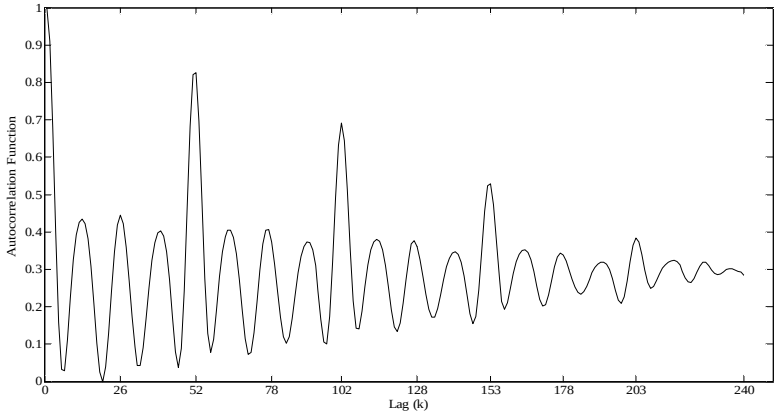
OR

Q.3 **(a)** Explain co-articulation and prosody. **07**

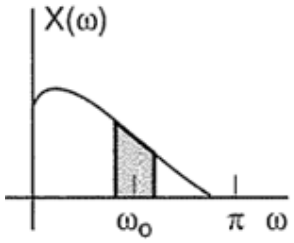
(b) Consider the following figure which shows the short-time autocorrelation function of some sound segment extracted from a speech waveform sampled at a rate of 8 kHz. **07**

(a) Is the sound segment voiced or unvoiced?

(b) Estimate the pitch in Hz. What is the pitch period in samples? What is pitch Period in milliseconds?



Q.4 **(a)** Show that discrete STFT can be expressed as the outputs of a set of analysis filters. Also Draw its block diagram representation and graphically show STFT of signal X(ω) as shown in figure below by assuming rectangular window. **07**



(b) Explain the concept of Linear Predictive Coding (LPC). **07**

OR

Q.4 **(a)** Explain Filter bank summation method in detail. **07**

(b) What is application of Linear Predictive Coding? Briefly explain difference between autocorrelation and covariance method of Linear prediction. **07**

Q.5 **(a)** Explain difference between complex cepstrum of voiced speech and unvoiced speech. **07**

(b) Explain isolated digit recognition system. **07**

OR

Q.5 **(a)** Write a short note on homomorphic systems for convolution. **07**

(b) Explain speaker recognition system. **07**

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