Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2014

Subject code: 1724105 **Date: 05-12-2014**

Subject Name: Speech Signal Processing and Applications

Time: 02:30 pm - 05:00 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)** Explain speech production model in detail. **07**

(b) Explain the effect of spectral sampling by considering two signals as follows: **07**

$$x[n]=\begin{cases}\cos\left(\frac{2\pi}{14}n\right)+0.75\cos\left(\frac{4\pi}{15}n\right) & 0\le n\le 63\\ 0 & else\end{cases}$$

and

$$y[n]=\begin{cases}\cos\left(\frac{2\pi}{16}n\right)+0.75\cos\left(\frac{2\pi}{8}n\right) & 0\le n\le 63\\ 0 & else\end{cases}$$

Q.2 **(a)** Explain three groups of organs for speech production and three phase of speech production associated with them. **07**

(b) Draw phoneme classification hierarchy with example in each category. **07**

OR

(b) Give manner of articulation and voicing for underline letter for each word given below: **07**

<u>W</u>ell, si<u>n</u>g, <u>d</u>ust

Q.3 **(a)** Explain vowel triangle. **07**

(b) Briefly explain term : coarticulation. Explain anticipatory and carry over coarticulation **07**

OR

Q.3 **(a)** What is VOT? Explain VOT in unvoiced and voiced plosives. **07**

(b) Explain terms Short time energy and Short time magnitude. What are pros and cons of these two features? What are the applications of these features in speech processing? **07**

Q.4 **(a)** Define Modified Short time Autocorrelation Function and explain pitch detection using it. **07**

(b) Write equation of Short time Fourier synthesis. Explain two necessary conditions to ensure uniqueness and invertibility of discrete STFT. **07**

OR

Q.4 **(a)** Explain Autocorrelation method of linear prediction. **07**

(b) Explain Filter Bank Summation method. **07**

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

(b) Explain application of LPC in spectral estimation. **07**

OR

Q.5 **(a)** Which are the speech processing applications uses pitch as a parameter? Explain any one application in detail which uses pitch as a parameter. **07**

(b) Define complex cepstrum and mention its properties by considering the most general form of rational z-transform. **07**

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