

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**

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

and

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

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**Well, sing, dust**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**
