GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER – II • EXAMINATION – WINTER 2012

Subject code: 1724105Date: 02-01-2013Subject Name: Speech Signal Processing and ApplicationsTime: 10.30 am – 01.00 pmTotal Marks: 70			
Instr	ruct 1. 2. 3.	ions: Attempt all questions. Make suitable assumptions wherever necessary. Figures to the right indicate full marks.	
Q.1	(a) (b)	What are phonemes? Discuss all different bases for their classification. Draw vowel triangle and explain its importance.	07 07
Q.2	(a) (b)	Write a short note on coarticulation. Glottal flow source of a voiced sound given is by $u[n] = g[n]*p[n]$, where $p[n] = \sum_{k=-\infty}^{\infty} \delta[n-kP]$, <i>P</i> is pitch period and $g[n]$ is glottal pulse. Determine DTFT of the windowed segment $x[n,\tau]=w[n,\tau] \{h[n]*(g[n]*p[n])\}$, where $h[n]$ is the vocal tract transfer function and $w[n,\tau]$ is a window centered at τ . Sketch a typical DTFT, with τ fixed, of a voiced sound.	07 07
	(b)	A 10 kHz sinusoidal signal is sampled at 80 kHz and 64 samples are collected and used to compute the 64-point DFT of this signal. At what DFT indices would you expect to see any peaks in the DFT?	07
Q.3	(a) (b)	Define short-time autocorrelation function and explain the pitch detection method using it. Also explain the need of spectrum flattening. Derive the equation of Filter Bank Summation (FBS) constraint.	07 07
Q.3	(a) (b)	Write and explain the algorithm for end-point detection of a given speech signal using short-time energy and short-time zero crossing rate. Explain filtering view of short-time Fourier transform.	07 07
Q.4	(a) (b)	Discuss three shortcomings of linear prediction. For each limitation, mention whether or not homomorphic processing can avoid it. Explain the use of pre-emphasis for speech analysis.	07 07
Q.4	(a) (b)	Explain spectral estimation via LPC in detail. Explain challenges in pitch detection and list its applications.	07 07
Q.5	(a)	Determine and sketch the complex cepstrum of the sequence $h[n] = \delta[n] + \alpha \delta[n - n_0]$. Assume $ \alpha < 1$.	07
	(b)	Write a short note on homomorphic systems for convolution. OR	07
Q.5	(a)	Determine the complex cepstrum of $x_1[n] = a^n u[n]$, $ a < 1$.	07
	(b)	Define complex cepstrum and mention its properties by considering the most general form of rational z-transform.	07
