



SILVER OAK UNIVERSITY

College of Technology
Master of Technology
Electronics and Communication
Course Name: Speech Processing.
Course Code: 1010097136
Semester: 1st

Prerequisite:

Digital signal processing

Course Objective:

1. Focuses on methods for recording speech and other vocal signals, for processing and modifying such recordings, and for synthesizing artificial speech.
2. Necessary background in speech science is provided. In addition to class discussion and short, hands-on exercises, each student develops, executes, and presents a hands-on term project.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit No.	Course Contents	Teaching Hours	Weightage %
1	<p>Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production- Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals.</p>	7	20
2	<p>Time Domain Models for Speech Processing: Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech Vs Silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period, estimation using the autocorrelation function.</p>	9	20
3	<p>Speech Recognition: Basic pattern recognition, preprocessing, Parametric representation, Evaluating the similarity of speech patten, Accommodating both spectral and temporal variability, Network for speech recognition, Language model, Artificial neural networks. Summary of current speech recognition design.</p>	10	20
4	<p>Homomorphic Speech Processing: Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The Homomorphic Vocoder. Speech Enhancement: Nature of interfering sounds, Speech enhancement techniques</p>	10	20
5	<p>Applications: Data compression, Vocoders, speech enhancement, speech recognition speaker recognition, aids for the speech and hearing impairments.</p>	6	20

Course Outcome:

Sr. No.	CO statement	Unit No
CO-1	Understand basic concepts of speech production, speech analysis, speech coding and parametric representation of speech and apply it in practical Applications	1,3
CO-2	Develop systems for various applications of speech processing	1,2,3
CO-3	Learn Signal processing models of sound perception and application of perception models in audio signal processing.	3,4
CO-4	Implement audio compression algorithms and standards.	5

Teaching & Learning Methodology: -

1. Direct Instruction
2. Flipped Classrooms
3. Kinesthetic Learning
4. Context-Based Learning
5. Adaptive Teaching

List of Experiments/Tutorials:**Total Hours: 28**

Sr. No.	Practical Name
1	To study the effects of windowing.
2	To understand the difference between stationary and non-stationary signals.
3	To extract a slice of speech signal and compute its spectrum for different window length.
4	To simulate periodic glottal pulse train.
5	To synthesize vowel using source filter model.
6	To compute wideband and narrowband spectrogram of a given speech signal.
7	To compute short-time energy and ZCR of a given speech signal.
8	To compute short-time autocorrelation function and plot pitch contour for given utterance.

Major Equipment:

MATLAB signal processing toolbox Praat: doing phonetics by computer (version 5.4.01)

Books Recommended:-

1. D O'shaughnessy, Speech Communication: Human and Machine, Addison Wesley.
2. L R Rabiner and R W Schafer, Digital Processing of Speech Signals, Prentice Hall
3. J Flanagan, Speech Analysis, Synthesis, and Perception, Springer Verlag.
4. W. Rappaport, Wireless Communication.

List of Open Source Software/learning website:

Sakshat Virtual Labs, IIT Guwahati

CO-PO Matrix:

CO No.	P O 1	PO 2	PO 3	PO 4	PO 5	PO 6	P O 7	P O 8	P O 9	P O 10	P O 11	PO 12	PSO1	PSO 2
CO-1	3	2	2		2	1		1	1		1	2		3
CO-2			2						1			2		3
CO-3		3		3	3	3		1	2			2		-
CO-4	3	3	3			2			2			2		3