SPEECH SIGNAL PROCESSING

Course Code	20EC6501D	**Year**	III	**Semester**	I
Course Category	**HONORS**	**Branch**	ECE	**Course Type**	THEORY
Credits	4	**L-T-P**	3-1-0	**Prerequisites**	Digital Signal Processing, Random Process
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand speech recognition principles, methods, models and implementation (L2)
CO2	Apply speech recognition principles &methods to characterize the speech signal and to recognize the speech (L3)
CO3	Apply the Pattern Comparison Techniques and Hidden Markov Models to recognise the speech (L3)
CO4	Analyse the speech recognition methods, pattern comparison techniques and Hidden Markov Models (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)
Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation
* - Average value indicates course correlation strength with mapped PO

Cos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	3							1	2	2				
CO2	2							1	2	2				
CO3	3							1	2	2				
CO4		3						1	2	2				
Average* (Rounded to nearest integer)	3	3						1	2	2				

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**The Speech Signal:** Fundamentals of Speech recognition, the process of speech production and perception in human beings, the speech production process, representing speech in time and frequency domains, speech sounds and features.	CO1, CO2
II	**Signal Processing and Analysis methods for Speech Recognition:** Spectral analysis models, The Bank-of-filters front-end processor, Linear predictive coding model for Speech recognition, Vector quantization.	CO1,CO2, CO4

III	**Pattern Comparison Techniques:** Introduction, Speech detection, Distortion measures- Mathematical considerations, Distortion measures- Perceptual considerations, Spectral distortion measures.	CO1, CO3, CO4
IV	**Theory and Implementation of Hidden Markov Models:** Introduction, Discrete time Markov processes, Extensions to Hidden Markov models, Three basic problems for HMMs, Types of HMMs, Continuous observation densities in HMMs, comparison of HMMs, Implementation issues for HMMs, HMM system for isolated word recognition.	CO1, CO3, CO4
V	**Large Vocabulary continuous speech recognition:** Introduction, Sub word speech units, sub word unit models based on HMMs, Training of sub word units, Language models for Large vocabulary speech recognition, Statistical language modelling, Perplexity of the language model,Overall recognition system based on sub word units.	CO1,CO3, CO4

Learning Resources
Text Books
1. Lawrence Rabiner and Biing-Hwang Juang, Fundamentals of Speech Recognition, Pearson Education, 2007.
Reference Books
1. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, Fundamentals of Speech Recognition, Pearson Education, 2009. 2. Claudio Becchetti and Lucio Prina Ricotti, Speech Recognition, John Wiley and Sons, 1999. 3. Frederick Jelinek, Statistical Methods of Speech Recognition, MIT Press, Cambridge, MA; London, England, 1997. 4. Daniel Jurafsky and James H Martin, Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Pearson Education, 1st Ed., 2000.
e- Resources & other digital material
1. https://nptel.ac.in/courses/117105145 2. https://ocw.mit.edu/courses/6-345-automatic-speech-recognition-spring-2003/ 3. https://www.classcentral.com/course/youtube-digital-speech-processing-47859