

Course Code	Course Title	L	T	P	C
1152EC134	SIGNAL PROCESSING TECHNIQUES FOR SPEECH RECOGNITION	3	0	0	3

a) Course Category

Program elective

b) Preamble

This course provides concepts, methodology and analysis of speech signals. Speech signal recognition is important for speech-to-text and text-to-speech conversion of signal. This course also covers the basic speech recognition techniques and distortion measures to analyze the speech signal.

c) Prerequisite

Signals and Systems, Digital Signal processing

d) Related Courses

Digital Video Signal Processing

e) Course educational objectives

- Learn speech production and related parameters of speech
- Understand the basic concepts of speech production, speech processing and analysis
- Study the different speech modeling procedures and their implementation issues
- Understand basics of Hidden Markov Models and large vocabulary speech recognition

f) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe the fundamentals of speech and speech production system	K2
CO2	Compare the speech analysis techniques by considering various distortion measures.	K3
CO3	Explain source coding technique and Discriminative methods for speech recognition.	K2
CO4	Explain Hidden Markov Models for a given application.	K2

CO5	Explain the architecture and basic blocks of large vocabulary speech recognition system	K2
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g) Correlation of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	L	L	-	-	-	-	-	-	-	M	-	-
CO2	H	M	M	M	L	-	-	-	-	L	-	L	-	-
CO3	M	M	L	-	L	-	-	L	L	L	-	L	-	-
CO4	L	M	L	L	L	-	-	-	-	-	-	L	-	-
CO5	L	-	-	-	L	-	-	-	-	-	-	L	-	-

h) Course Content

UNIT I BASIC CONCEPTS 9

Fundamentals of speech recognition, Speech signal-speech production process, representing speech in the Time and Frequency Domains, Speech sounds and features, Automatic Speech Recognition-Acoustic-phonetic, statistical pattern- Recognition, AI, Neural Networks and their applications.

UNIT II SIGNAL PROCESSING ANALYSIS AND DISTORTION MEASURES 10

Spectral analysis model, Filter banks, Linear predictive coding model, vector quantization, speech detection, Distortion measures-Mathematical, Perceptual and spectral-Log-Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Time Alignment and Normalization-Dynamic Time Warping, Multiple Time-Alignment Paths.

UNIT III SPEECH RECOGNITION SYSTEM DESIGN 9

Source coding techniques application- Vector quantization and pattern comparison, Template training-causal, robust, clustering, Performance analysis and recognition, Discriminative methods in recognition-weighting functions, training for minimum recognition error, Speech recognition in adverse environments.

UNIT IV INTRODUCTION TO HIDDEN MARKOV MODELS 9

Hidden Markov Model: Introduction, Discrete Markov Processes, Extension to HMMs, three basic problems for HMM, Types of HMM, Implementation issues.

UNIT V LARGE VOCABULARY SPEECH RECOGNITION 8

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech

recognition system, language models-statistical, perplexity, context dependent sub-word units.

Total 45 Hrs

i) Learning Resources

Text Books

1. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", 1st edition, Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 2nd edition, Pearson Education, 2002.

Reference Books

1. Thomas F Quatieri, "Discrete-Time Speech Signal Processing –Principles and Practice", Pearson Education, 2006
2. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1998

Online Resources

1. <http://nptel.ac.in/syllabus/117104023>