EC324: Speech Processing

Details of course: -

Course Title	Course Structure			Pre-Requisite
	L	T	P	
Speech Processing	3	0	2	Signals and Systems, Probability Theory, and Digital Signal Processing

Course Objective: This course provides the foundation knowledge on speech production and perception along with processing of speech signal in digital domain.

Course Outcomes:

   CO1: Analyse the speech production mechanism.

   CO2: Illustrate the signal processing methods for speech recognition.

   CO3: Describe various speech features extraction methods in time and frequency domain.

   CO4: Design speech recognition system and identify implementation issues.

   CO5: Explain models for automatic speech recognition.

S. No.	Content	Contact Hours
Unit 1	The Speech Production mechanism: Physiological and Mathematical Model, Relating the physiological and mathematical model, Categorization of Speech Sounds based on the source-system and the articulatory model.	8
Unit 2	Basic Speech Signal Processing Concepts: Discrete time speech signals, relevant properties of the fast Fourier transform and Z-transform for speech recognition, convolution, linear and non-linear filter banks, Spectral estimation of speech using the Discrete Fourier transform, Pole-zero modeling of speech and linear prediction (LP) analysis of speech, Homomorphic speech signals de convolution, real and complex spectrum, application of cepstral analysis to speech signals.	10
Unit 3	The Speech Recognition Front End: Feature extraction for speech recognition, Static and dynamic features for speech recognition, robustness issues, discrimination in the feature space, feature selection, Mel frequency cepstral co- efficient (MFCC), Linear	8

	prediction cepstral coefficients (LPCC), Perceptual LPCC.	
Unit 4	Distance measures for comparing speech patterns: Log spectral distance, cepstral distances, weighted cepstral distances, distances for linear and warped scales, Dynamic Time Warping for Isolated Word Recognition.	8
Unit 5	Statistical models for speach recognition, Vector quantization models and applications in speaker recognition, Gaussian mixture modeling for speaker and speech recognition, Discrete and Continuous Hidden Markov.	8
	Total	42

Books: -

S. No	Name of Books/Authors/Publisher
1	Speech and Language Processing – An Introduction toNatural Language Processing, Computational Linguistics, and Speech Recognition/Daniel Jurafsky and James H Martin/PearsonEducation, 2013.
2	Fundamentals of Speech Recognition/Lawrence RabinerandBiingHwang/ PearsonEducation, 2003.
3	Digital Processing of Speech Signals/L.R. Rabiner and S. W. Schafer/Pearson Education,2008.
4	Speech and audio signal processing andperception of speech and music/ Ben gold and Nelson Morgan/Wiley- India Edition, 2006 Edition.
5	Discrete-Time Speech Signal Processing – Principles and Practice/ Thomas F Quatieri, Pearson Education, 2001.