	National Institute of Technology Meghalaya An Institute of National Importance	**CURRICULUM**

Programme	**Bachelor of Technology in Electronics and Communication Engineering**	Year of Regulation	**2018 – 19**
Department	Electronics and Communication Engineering	Semester	**VII**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EC 423	**Machine Learning and Speech Technology**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	Introducing of various mathematical methods involved in machine learning (ML).	Course Outcomes	CO1	Able to explain mathematical methods in developing of machine learning techniques.
	Introducing of short-time processing of speech signals and time-frequency analysis of speech signals.		CO2	Able to develop the short-term processing methods for speech analysis.
	Introducing of the fundamentals of ML techniques useful for speech processing applications.		CO3	Able to perform analysis of speech signals using time-frequency representation.
			CO4	Able to develop ML techniques for speech recognition, signal and source separation.

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	CO1	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**-**
2	CO2	**1**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**2**	**-**
3	CO3	**-**	**2**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**-**
4	CO4	**-**	**2**	**-**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**-**

SYLLABUS

No.	Content	Hours	Cos
I	Refreshing of linear algebra, probability theory and digital signal processing. Machine Learning (ML) basics: supervised and unsupervised learning, classification and regression, evaluation metrics. Probability Models and Expectation Maximization Algorithm: Gaussian Mixture Models. Neural Networks and Deep Learning: multi-class classification and multi-lable classification, different kinds of non-linearities, objective functions and learning methods	**10**	**CO1**
II	Speech production and perception, information sources in speech, linguistic aspect of speech, acoustic and articulatory phonetics, nature of speech, models for speech analysis and perception; Short-term processing: need, approach, time, frequency and time-frequency analysis; Speech enhancement.	**12**	**CO2, CO3**
III	ML for audio classification: time series analysis, LSTMs and CNNs ML for speech recognition: Hidden Markov Models, finite state transducers and dynamic programming.	**08**	**CO4**
IV	ML for Music Information Retrieval: Latent Variable Models, Matrix Factorization and Signal Separation	**06**	**CO4**
	Total Hours	**36**	

Essential Readings

1. J. R. Deller, Jr., J. H. L. Hansen and J. G. Proakis, “Discrete-Time Processing of Speech Signals”, WileyIEEE Press, NY, USA.
2. C.M. Bishop, "Pattern Recognition and Machine Learning", 2nd Edition, Springer, 2011.
3. I. Goodfellow, Y, Bengio, A. Courville, "Deep Learning", MIT Press, 2016.
4. D. Yu and L. Deng, "Automatic Speech Recognition: A Deep Learning Approach", Springer, 2016.

Supplementary Readings

1. L.R. Rabiner and R.W. Schafer, “Digital Processing of Speech Signals”, Pearson Education.
2. D. O’Shaughnessy, “Speech Communications: Human and Machine”, University Press.
3. T. F. Quatieri, “Discrete time processing of speech signals”, Pearson Education.