	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	**VIII**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EC 440	**Information Theory and Coding**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	Course Outcomes		
To enhance knowledge of probabilities, entropy, and measures of information.		CO1	Able to **understand** the basic notions of information and entropy
To introduce information theory, the fundamentals of error control coding techniques and their applications		CO2	Able to **analyse** the fundamental limits on performance of communication systems channels.
To develop noise immune information system		CO3	Able to **evaluate** a suitable lossy data compression technique for a given situation in communication systems
		CO4	Able to **analyse** the performance of error control codes, convolutional and block codes

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**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**3**	**2**
2	CO2	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**2**	**3**
3	CO3	**2**	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**1**
4	CO4	**2**	**3**	**3**	**-**	**2**	**2**	**3**	**-**	**2**	**-**	**-**	**1**	**2**	**3**	**2**	**2**

SYLLABUS

No.	Content	Hours	COs
I	**Introduction to Information and Entropy:** Information preview, Entropy of a source, Properties of entropy, Joint and conditional entropies, Mutual information, Relationship between entropy and mutual Information, Chain rules for entropy, Jensen's inequality and its consequences, Log sum inequality and its applications, Data processing inequality, Sufficient statistics, Fano's inequality.	**08**	**CO1**
II	**Information Channels** Information Channels, BSC and BEC Channels, Noiseless and Deterministic Channels, Cascaded Channels, Additivity of Mutual Information, Channel Capacity: Maximum Mutual Information (BSC and BEC), Channel Capacity of Weakly Symmetric Channels, Continuous Channels and Gaussian Channels, Information Capacity Theorem.	**08**	**CO1, CO2**
III	**Source Coding and Data Compression:** Instantaneous Codes, Examples of codes, Kraft inequality, Shannon's Noiseless Coding Theorem, Optimal codes, Bounds on the optimal code length, Huffman codes, Optimality of Huffman codes, Some comments on Huffman codes, Optimality of Huffman codes, Shannon–Fano–Elias coding, Competitive optimality of the Shannon code. Generation of discrete distributions from fair coins. Basic Concepts of Data Compression, Block-sorting Compression, Dictionary Coding, Statistical Compression, Prediction by Partial Matching, Image Coding.	**10**	**CO3**
IV	**Error-Correcting Codes:** Hamming Distance, Rings and Fields, Linear Spaces, Linear Spaces over the Binary Fields, Linear Codes, Encoding and Decoding, Codes Derived from Hadamard Matrices, Cyclic Codes: The Golay Code, Hamming Codes, Cyclic Redundancy Check Codes, Reed-Muller Codes, Burst-Correcting Codes: Bursts of Errors, Bose-Chaudhuri-Hocquenghem Codes, Reed-Solomon Codes. Convolutional Codes: Binary Convolutional Code, The Viterbi Algorithm, Trellis Modulation, Turbo Codes, Case study.	**10**	**CO4**
	Total Hours	**36**	

Essential Readings

1. M. Thomas et al., Elements of information theory. John Wiley & Sons, 2nd Edition, 2006.
2. R. Togneri et al, Fundamentals of information theory and coding design. CRC Press, 1st Ed., 2003.

Supplementary Readings

1. M. Borda. *Fundamentals in information theory and coding*. Springer Science & Business Media, 1st Ed., 2011.
2. M. Kelbert, et al., *Information theory and coding by example*. Cambridge University Press, 1st Ed., 2013.