

## ADVANCED DIGITAL MODULATION AND CODING TECHNIQUES

<b>Course Code</b>	20EC6501B	<b>Year</b>	III	<b>Semester</b>	I
<b>Course Category</b>	Honors	<b>Branch</b>	ECE	<b>Course Type</b>	Theory
<b>Credits</b>	4	<b>L-T-P</b>	3-1-0	<b>Prerequisites</b>	Digital Communications
<b>Continuous Internal Evaluation:</b>	30	<b>Semester End Evaluation:</b>	70	<b>Total Marks:</b>	100

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<b>Course Outcomes</b>	
Upon successful completion of the course, the student will be able to	
<b>CO1</b>	Illustrate different digital modulation schemes - L2
<b>CO2</b>	Apply the knowledge in designing turbo codes-L3
<b>CO3</b>	Design encoders and decoders for Space-Time Codes –L4
<b>CO4</b>	Understand the significance of LDPC and POLAR codes in various applications-L2

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<b>Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)</b>														
Note: 1- Weak correlation    2-Medium correlation    3-Strong correlation														
* - Average value indicates course correlation strength with mapped PO														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												3	
CO2	3								2			2	3	
CO3		3								2		2	3	
CO4	3								2	2		3	3	
Average* (Rounded to nearest integer)	3	3							2	2		2	3	

<b>Syllabus</b>		
Unit No.	Contents	Mapped CO
I	<b>Passband Digital Modulation schemes</b> Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying	CO1
II	<b>Turbo Codes</b> Product codes, Iterative decoding of product codes, Concatenated convolutional codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding	CO2
III	<b>Low Density Parity Check codes</b> Definition, properties, LDPC codes in 5G, proto-graph, base matrix, expansion, Encoding LDPC codes in 5G , SISO decoders for repetition, SPC codes, log-likelihood ratio Decoding LDPC codes: message passing, iterations	CO4

IV	<b>Space-Time Codes</b> Introduction, Digital modulation schemes, Diversity, Orthogonal space- Time Block codes, Alamouti's schemes, Extension to more than Two Transmit Antennas, Simulation Results, Spatial Multiplexing: General Concept, Iterative APP Pre-processing and Per-layer Decoding.	CO3
V	<b>Polar codes</b> Generator matrix, binary tree representation, frozen bits and information bits Encoding polar codes, Successive cancellation decoder for polar codes	CO4

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<b>Learning Resources</b>	
<b>Text Books</b>	
1. Wozencraft J. M. and Jacobs I. M., Principles of Communication Engineering', John Wiley, 1965	
2. Shu Lin, Daniel J. Costello, Error Control Coding- Fundamentals and Applications, Prentice Hall, Inc 2014	
<b>Reference Books</b>	
1. John G. Proakis -Digital Communications, 5 <sup>th</sup> Ed., TMH 2008.	
2. Salvatore Gravano-Introduction to Error Control Codes- Oxford	
<b>e- Resources &amp; other digital material</b>	
1.. <a href="https://nptel.ac.in/courses/108/105/108105159/">https://nptel.ac.in/courses/108/105/108105159/</a>	

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