SEMESTER S4

CODING THEORY

(Common to CS/CM/AM/CI)

Course Code	**PECST414**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To introduce students to some of the classical methods in coding theory
2. To give the concept of code construction through the mathematical foundations and examples.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Binary block codes, Minimum distance, Error-detecting capability and error-correcting capability. Introduction to linear block codes, generator matrix and parity check matrix. Properties of linear block codes: Syndrome, error detection. Distance properties of linear block codes. Single parity check codes, Hamming codes, Reed Muller codes.	**9**
2	Cyclic Codes : Generator and Parity-Check Matrices of Cyclic Codes. Encoding of Cyclic Codes, Syndrome Computation and Error Detection, Decoding of Cyclic Codes, Cyclic Hamming Codes, Shortened Cyclic Codes	**9**
3	Convolutional codes: Encoding, state diagram, trellis diagram, Classification, realization, distance properties. Viterbi algorithm, BCJR algorithm. Performance bounds for convolutional codes	**9**
4	Turbo codes: Turbo decoding, Distance properties of turbo codes, Convergence of turbo codes. Automatic repeat request schemes. Applications of linear codes	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Construct the encoder and decoder of linear block codes	**K3**
CO2	Understand the concept of error correction coding	**K2**
CO3	Understand the implementation of cyclic codes	**K2**
CO4	Apply Viterbi algorithm for decoding convolutional codes	**K3**
CO5	Experiment with turbo codes using iterative map and BCJR algorithm	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3									2
CO2	3	3	3	2								2
CO3	3	3	3	2								2
CO4	3	3	3									2
CO5	3	3	3	2								

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Error Control Coding	Shu Lin and Daniel J. Costello, Jr.	PHI	2/e, 2004
2	Error Correction Coding	Todd K. Moon	Wiley-Interscience	1/e, 2006

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The Theory of Error-Correcting Codes	F. J. MacWilliams, N. J. A. Sloane	North-Holland, Amsterdam	1/e, 1977
2	Algebraic Codes for Data Transmission	R. E. Blahut	Cambridge University Press	1/e, 2003
3	Fundamentals of Error-Correcting Codes	Cary W. Huffman, Vera Pless	Cambridge University Press	1/e, 2003

Video Links (NPTEL, SWAYAM…)	
Mod. No.	**Link ID**
1	https://archive.nptel.ac.in/courses/108/104/108104092/
2	https://nptel.ac.in/courses/108102117
3	https://archive.nptel.ac.in/courses/108/104/108104092/
4	https://archive.nptel.ac.in/courses/108/104/108104092/