**19EC3201 – INFORMATION THEORY AND CODING**

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| **Course category:** | | Program core | | **Credits:** | 3 |
| **Course Type:** | | Theory | | **Lecture - Tutorial - Practical:** | 3 - 0- 0 |
| **Prerequisite:** | | Data types, Communication theory, basics of computer networks | | **Sessional Evaluation :**  **External Evaluation:**  **Total Marks:** | 40  60  100 |
| **Course**  **Objectives** | Students undergoing this course are expected to understand: | | | | |
| 1. The Mutual information, information rate, channel capacity, redundancy and efficiency of channels. 2. The discrete and continuous channels. 3. The Construction of basic source codes – Shannon-Fano algorithm, Huffman coding, Arithmetic coding, ZIP coding. 4. The Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes. 5. The Decoding of cyclic codes, BCH codes, RS codes, Burst error correction. 6. The Sequential decoding, Stack algorithm, Block and convolutional interleaving. | | | | |
| **Course Outcomes** | Upon successful completion of the course , the students will be able to: | | | | |
| CO1 | | Understand the fundamentals of information Theory. | | |
| CO2 | | Explain different type of discrete channels and continuous channels | | |
| CO3 | | Learn various coding techniques and algorithms. | | |
| CO4 | | Know the different types of Codes for Error Detection and Correction | | |
| CO5 | | Understand the Syndrome computation and error detection, Decoding of cyclic codes | | |
| CO6 | | Know the Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes | | |
| **Course**  **Content**  **Course**  **Content** | **UNIT I**  **INFORMATION THEORY** – Concept of amount of information -units, Entropy -Marginal, Conditional and Joint entropies -Relation among entropies, Mutual information, information rate, channel capacity, redundancy and efficiency of channels.  **UNIT II**  **DISCRETE CHANNELS** – Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Cascaded channels, repetition of symbols, Binary unsymmetric channel, Shannon theorem.  **CONTINUOUS CHANNELS** – Capacity of band limited Gaussian channels, Shannon-Hartley theorem, Trade off between Bandwidth and signal to noise ratio, Capacity of a channel with infinite band width, Optimum modulation system. **UNIT III**  **SOURCE CODING** – Encoding techniques, Purpose of encoding, Instantaneous codes, Construction of instantaneous codes, Kraft’s inequality, Coding efficiency and redundancy, Noiseless coding theorem. Construction of basic source codes – Shannon-Fano algorithm, Huffman coding, Arithmetic coding, ZIP coding.  **UNIT IV**  **CODES FOR ERROR DETECTION AND CORRECTION** – Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes.  **UNIT V**  **CYCLIC CODES –** Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction.  **UNIT VI**  **CONVOLUTIONAL CODES** – Encoding- State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes -Viterby algorithm, Sequential decoding -Stack algorithm. Block and convolutional interleaving, CIRC encoding and decoding. | | | | |
| **Text Books and Reference Books** | **TEXT BOOKS:**  1. Communication Systems Simon Haykin, John Wiley & Sons. Pvt. Ltd.  2. Principles of Communication Systems Taub & Schilling, Tata McGraw-Hill  3. Principles of Digital Communication Das, Mullick&Chatterjee, Wiley Eastern Ltd.  **REFERENCE BOOKS:**  1. Error Control Coding Fundamentals and Applications Shu Lin & Daniel J. Costello  Jr., Prentice Hall Inc.  2. Digital Communications Fundamentals and Applications Bernard Sklar, Person  Education Asia | | | | |
| **E-Resources** | 1. https://nptel.ac.in/courses/106105082 | | | | |

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| **Contribution of Course Outcomes towards achievement of Program Outcomes** | | | | | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 1 | 1 | - | - | - | - | - | - | 2 | 2 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO6 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 |