<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Information Theory</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">Dr R Sri Prakash</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">UG/PG</td><td>Type</td><td colspan="2">Core ☐</td><td colspan="2">Elective ■</td></tr>
<tr><td>Status</td><td colspan="2">New ■</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td>Probability theory</td><td colspan="3">Submitted for approval</td><td></td></tr>
<tr><td>Learning Objectives</td><td colspan="6">● Understand the fundamental concepts of information, entropy, mutual information, and channel capacity in communication systems.
● Analyse source and channel coding theorems to quantify information transfer and limits of reliable communication.
● Apply information-theoretic principles to design and evaluate efficient compression and coding schemes for practical systems.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">● Explain key concepts such as entropy, mutual information, and channel capacity, and their roles in quantifying information.
● Derive and evaluate source and channel coding theorems to determine the limits of data compression and reliable communication.
● Apply information-theoretic methods to design efficient coding and compression techniques for real-world communication systems.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to information theory, Entropy, relative entropy and mutual information, Asymptotic equipartition property (L12+T4)
Data compression: Kraft Inequality, Optimal Codes, Bounds on the Optimal Code Length, Kraft Inequality for Uniquely Decodable Codes, Huffman Codes, Shannon-Fano-Elias Coding (L9+T3)
Channel capacity: Examples of Channel Capacity, Properties of Channel Capacity, Preview of the Channel Coding Theorem, Jointly Typical Sequences, Channel Coding Theorem (L8+T2)
Differential entropy: Definitions, Joint and Conditional Differential Entropy, Relative Entropy and Mutual Information, Properties of Differential Entropy, Relative Entropy, and Mutual Information (L10+T4)
Gaussian channel: Definitions, Converse to the Coding Theorem for Gaussian Channels, Bandlimited Channels, Parallel Gaussian Channels (L3+T1)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. T.M. Cover and J.A.Thomas, Elements of Information Theory, 2nd edition, Wiley, ISBN: 0471062596, 1991.
2. R.G.Gallager, Information Theory and Reliable Communication, 1st edition, Wiley, ISBN: 0471290483, 1967.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. "A Mathematical Theory of Communication" : Shannon's original paper.
2. Csiszar and Korner, Information Theory, 2nd edition Cambridge University Press, ISBN: 1107565049, 2015.</td></tr>
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