Digital Communications

Instructors: Prof. Deepak Ghodgaonkar and Prof. Abhishek Jindal

Course Code: CT303

Students: B. Tech. 5th Semester

Structure: 3-0-3-4.5


Time Table: Tuesday (8:30 to 9:45 am) and Friday (10:15 to 11:30 am)

Syllabus

Module 1: Introduction to digital communication systems and digitization of analog signals
- Analog versus digital communications, overview of digital communication based system, review of sampling theorem, ideal and practical sampling, aliasing, analog signal reconstruction from discrete-time samples, pulse code modulation (PCM): uniform and non-uniform quantization and companding, and Differential PCM.

Module 2: Digital modulation
- Signal space concepts: representation of signals as vectors and Gram-Schmidt orthonormalization. Signal representation and constellations: amplitude shift keying (ASK), phase shift keying (PSK), rectangular and non-rectangular quadrature amplitude modulation (QAM) and frequency shift keying (FSK). Design for bandlimited channels: power-bandwidth tradeoff and Nyquist criterion for ISI avoidance.

Module 3: Digital demodulation and detection
- Optimal demodulation in additive white Gaussian noise (AWGN): maximum-likelihood (ML) decision rule and minimum probability error (MEP) decision rule. Realization of optimal receiver using matched filters. Performance analysis of ML reception and link-budget analysis.

Module 4: Elements of Information theory
- Notion of channel capacity, capacity of discrete-time AWGN channel: sphere packing interpretation, capacity of band-limited AWGN channel, power-bandwidth tradeoff in bandlimited AWGN channel, and design implications of Shannon limits.

References:

Evaluation:

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<tr>
<th>Evaluation Category</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>In-Semester Examination (27 to 30 September)</td>
<td>- 42%</td>
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<tr>
<td>End-Sem Exam (13 to 20 December)</td>
<td>- 43%</td>
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<tr>
<td>Laboratory Work</td>
<td>- 15%</td>
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