Digital Communications

Instructors: Prof. Deepak Ghodgaonkar

Course Code: CT303

Students: B. Tech. 5th Semester

Structure: 3-0-3-4.5


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. (10 hours)

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. (12 hours)

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. (12 hours)

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. (10 hours)

References:


**Evaluation:**

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<th>Evaluation Category</th>
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<td>First In-Semester Examination (13 to 16 September)</td>
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**Course Outcome:**

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