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| **Department of Telecommunication Engineering** |
| **Digital Communications (10646342)** |
| **Total Credits** | **3** |
| **major compulsory** |
| **Prerequisites** | P1 : Communication principles (10646322) |
| **Course Description** |
| Review of sampling process. Quantization process, pulse code modulation, TDM, digital multiplexer, quantization noise in PCM systems. Delta-sigma modulation, linear predictive coding (introduction). Differential pulse code modulation. Baseband digital transmission. Baseband communication model. Matched filter. Error rate due to noise Detection of base band signals in AWGN. Inter-Symbol Interference (ISI). Nyquist criteria for distortion less channel. M-ary baseband transmission. Correlative level coding. Passband digital transmission: Passband transmission model. Coherent phase shift keying, M-ary phase shift keying (QPSK and M-ary PSK). Hybrid amplitude/Phase modulation schemes (M-ary-QAM). Coherent Frequency shift keying. Non coherent orthogonal modulation. Non coherent binary FSK. Differential phase shift keying, M-ary FSK. Effect of noise on various modulation scheme. Average probability of error versus increased bandwidth transmission. |
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| **Intended Learning Outcomes (ILO's)** | **Performance Indicators(PI's)** | **Contribution** |
| i | Ability to apply knowledge of mathematics, science and engineering to study noise effect, average probability of error, spectral efficiency of baseband passband communication system. |  1.1  | 40 % |
| ii | Ability to design digital communication system that meets, spectral efficiency, noise effect and average probability of error |  2.3 | 40 % |
| iii | Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (i.e., course project) |  7.2 | 20 % |

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| **Textbook and/ or References** |
| 1. B.P. Lathi, “Modern Digital and Analog Communication Systems,”3rd edition, Oxford University Press.2. Simon Haykin, “Communication Systems,” 4th edition, John Wiley and sons.3. Tomasi, “Communication electronics”.4. Digital communications, Bernard Sklar, Prentice hall,5. Online Resources. |
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| **Assessment Criteria** | **Percent (%)** |
| First Exam | 25 % |
| Second Exam | 25 % |
| Final Exam | 50 % |
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| **Course Plan** |
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| **Week** | **Topic** |
| 1 | Review of sampling theorem |
| 2 | Review of pulse code modulation. Delta-sigma modulation. |
| 3 | Linear prediction. Differential pulse code modulation |
| 4 | Baseband pulse transmission, matched filter, error probability due to AWGN noise |
| 5 | Inter-symbol interference, Nyquist criteria for distortion-less channel |
| 6 | Raised cosine filtering, correlative level coding, Equalizer |
| 7 | Midterm exam 1 |
| 8 | Eye diagram, M-ary signaling, |
| 9 | Passband communication model, and digital modulation schemes Coherent phase shift keying: BPSK, QPSK, M-ary PSK modulation/demodulation, |
| 10 | Power spectral efficiency, and average probability of error, QAM modulation/demodulation and power spectral efficiency |
| 11 | Coherent frequency shift keying, BFSK, MFSK, M-ary FSK modulation/demodulation, power spectral efficiency, and average probability of error |
| 12 | Non-coherent demodulation, non coherent DPSK, non coherent FSK |
| 13 | Midterm exam 2 |
| 14 | Shannon’s theorem and channel capacity |
| 15 | Introduction to OFDM, and multiple access techniques |
| 16 | Final Exam |

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