

## Fundamentals of Analog and Digital Communication Systems

**Global Coordinator: Prof. Ratnajit Bhattacharjee**

Modules	Detailed Syllabus
<p><b>Review of Fundamental Concepts and Mathematical preliminaries</b> (10 Hours) Course/Module Coordinator: Prof. Ratnajit Bhattacharjee (IIT Guwahati)</p>	<p>Elements of an electrical communication system; Characteristics of communication channel and their mathematical modeling; Signal models: deterministic and random; signal classification; Convolution Integral and response of LTI system; Fourier series representation, Parseval's theorem; Fourier transform; Hilbert transform; Random Process: mean, correlation and covariance; stationary and ergodic processes; power spectral density; Gaussian Process.</p> <p>Evaluation: 1) Quiz 1. 2) Exam.</p>
<p><b>Analog communication systems</b> (14 Hours) Course/Module Coordinator: Dr. S Chakraborty/ Dr. Vinod P (IIT Roorkee)</p>	<p>Concept of modulation and demodulation, Continuous wave (CW) modulation: amplitude modulation (AM) - double sideband (DSB); double sideband suppressed carrier (DSBSC); single sideband suppressed carrier (SSBSC) and vestigial sideband (VSB) modulation, angle modulation - phase modulation (PM) &amp; frequency modulation (FM); narrow and wideband FM. Representation of narrowband noise; receiver model, signal to noise ratio (SNR), noise figure, noise temperature, noise in DSB-SC, SSB, AM &amp; FM receivers, pre-emphasis and de-emphasis.</p> <p>Evaluation: 1) Quiz 2. 2) Exam.</p>
<p><b>Pulse Modulation</b> (10 Hours) Course/Module Coordinator: Dr. V.V. Mani (NIT Warangal)</p>	<p>Sampling process, sampling theorem for band limited signals; pulse amplitude modulation (PAM); pulse width modulation (PWM); pulse position modulation (PPM) ; pulse code modulation (PCM); line coding; differential pulse code modulation; delta modulation and adaptive delta modulation, Basics of time division multiplexing, noise consideration in PAM and PCM systems.</p> <p>Evaluation: 1) Quiz 3. 2) Exam.</p>
<p><b>Basic digital modulation schemes and signaling over AWGN channels</b> (12 Hours) Course Coordinator: Dr. Satyasai J.Nanda (MNIT Jaipur) Module Coordinator: Prof. Vishwanath Sinha (MNIT Jaipur)</p>	<p>Overview of geometric representation of signals, Gram-Schmidt Orthogonalization procedure; Basic digital modulations schemes: Phase shift keying (PSK), amplitude shift keying (ASK), frequency shift keying (FSK) and Quadrature amplitude modulation (QAM); coherent demodulation and detection; probability of error. Basics of equivalent complex baseband representation of digitally modulated signals.</p> <p>Evaluation: 1) Quiz 4. 2) Exam.</p>
<p><b>Hands on</b> ( circuit design, assembly and measurements)  (24 Hours)</p>	<p>Amplitude modulation and demodulation (AM with carrier &amp; DSBSC AM); frequency modulation and demodulation (using VCO &amp; PLL); automatic gain control (AGC); pulse width modulation (PWM); pulse code modulation (PCM); pseudo-random (PN) sequence generation; Generation and detection of signals for binary phase shift keying (BPSK) and binary frequency shift keying (BFSK). BER performance of BPSK signals.</p>

<b>Lecture: 46 Hours Hands on : 24 Hours Pedagogy &amp; skill development : 10 hours</b>

**Course credits (total 4):**

- 3 credits for Quiz 1 – 4 and Exam.
- 1 Credit for all Lab viva/demo