

1.	Title of the course	Communication Systems
2.	Course number	EE211L
3.	Structure of credits (L-T-P-C)	3-0-0-3
4.	New course/modification to	Modified with EE304L/COMMUNICATION SYSTEMS
5.	To be offered by	Electrical Engineering
6.	Prerequisite	None
7.	Course Objective(s): To explore the fundamentals of communication systems including concepts of analog and digital communication, signal processing techniques required for understanding communication signals, modulation techniques, noise modeling, and optimal demodulation.	
8.	Course Content: Signal processing for communication: review of LTI systems and Fourier transforms, baseband and passband signal representation, up-conversion and down-conversion; Amplitude modulation (AM): conventional AM, double-sideband suppressed carrier (DSB-SC), single-sideband (SSB), vestigial-sideband (VSB); Angle modulation: phase modulation (PM), frequency modulation (FM), superheterodyne receiver, basics of phase-locked loops; Digital modulation: signal constellations, power spectral density, bandwidth occupancy, Nyquist sampling theorem, Nyquist criterion for ISI avoidance, orthogonal and biorthogonal modulation; Noise modeling: review of basic probability, joint Gaussianity, stationarity and wide-sense stationarity, Gaussian random process; Optimal demodulation: ML and MAP decision rules, signal-space concepts, bit-error probability, link-budget analysis.	
9.	Textbook(s): 1. Madhow U, Introduction to Communication Systems, Cambridge University Press (2014).	
10.	Reference(s): 1. Haykin S, Communication Systems, Wiley (2016). 2. Lathi B P and Ding Z, Modern Digital and Analog Communication Systems, Oxford University Press (2009).	