University of Tehran
School of Electrical and Computer Engineering

<table>
<tr><td>Course:</td><td colspan="10">8101354–Communication Systems I</td></tr>
<tr><td>Course type:</td><td></td><td colspan="6">EE*</td><td colspan="3">CE*</td><td rowspan="3">Credit: 3</td></tr>
<tr><td></td><td>Com</td><td>E</td><td>P</td><td>B</td><td>Con</td><td>D</td><td>SW</td><td>HW</td><td>IT</td></tr>
<tr><td>Required</td><td>☒</td><td>☒</td><td>☒</td><td>☒</td><td>☒</td><td>☒</td><td>☐</td><td>☐</td><td>☐</td></tr>
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<tr><td>Level:</td><td colspan="10">Undergraduate ■
Graduate ☐</td></tr>
<tr><td>Co-requisite(s):</td><td colspan="10">None</td></tr>
<tr><td>Prerequisite(s):</td><td colspan="10">Engineering probability and statistics(8101092),
Signals and systems (8101144)</td></tr>
<tr><td>Prerequisite by topic:</td><td colspan="10">Fourier analysis, analysis of linear systems, probability theory and random variables.</td></tr>
<tr><td>Textbook(s):</td><td colspan="10">[1] J. Proakis and M. Salehi, “Fundamentals of Communication Systems,” 2nd Edition, Prentice Hall, 2013.</td></tr>
<tr><td>Coordinator:</td><td colspan="10">A. Olfat, Associate Professor, School of ECE</td></tr>
<tr><td>Goals:</td><td colspan="10">The goal of this course is to teach students the basics of communication systems with the emphasis on:
1- Mathematical framework and fundamental elements of a communication systems.
2- The important parameters of communication systems such as power, bandwidth, quality, transmitter and receiver complexity and their trade-offs.
3- Performance analysis of communication systems in the presence of noise and channel distortions.</td></tr>
<tr><td>Outcome:</td><td colspan="10">Upon successful completion of the course, students will be able
1. To model stochastic signals and derive their important characteristics such as power spectrum.
2. To understand mathematical models for different modulations such as AM, DSB, SSB, VSB, PM and FM and to obtain their important parameters such as power spectrum and bandwidth.
3. To understand building blocks and circuits of modulator and demodulator of different analog modulations.
4. To analyze the performance of analog modulations in the presence of noise.</td></tr>
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	5. To learn multiplexing methods and noise analysis of analog repeaters. 6. To learn digital baseband modulations and computation of their bit error rate and power spectrum.
Topics:	1. Review of signals and systems. 2. Power spectral density and correlation function. 3. Complex envelope representation of bandpass signals and systems. 4. Review of probability theory. 5. Intoduction to stochastic processes, correlation function and power spectral density of stochastic processes. 6. Linear systems and stochastic processes. 7. Gaussian and white noise processes, Complex envelope representation of bandpass processes. 8. Linear analog modulation systems (Amplitude Modulation, Double-Sideband Modulation,Single-Sideband Modulation, Vestigial-Sideband Modulation) 9. Nonlinear analog modulation systems (Angle Modulation, Frequency Modulation). 10. Performance of analog modulation systems in the presence of noise. 11. Time division multiplexing and frequency division multiplexing. 12. Link budget analysis for analog repeaters. 13. Analog to digital conversion and Quantization. 14. Fundamentals of binary digital communications and their performance analysis in the presence of noise.
Computer usage:	MATLAB
Assignments:	10 assignments
Projects:	None

Grading:	Assignments: 10% Quiz: 5% Midterm exams: 40% Final exam: 45%
Further readings:	**[1]** J. Proakis and M. Salehi, "*Communication Systems Engineering*," 2nd Edition., Prentice Hall, 2002. **[2]** A.B. Carlson and P.B. Crilly, "*Communication Systems*," 5th Edition, McGraw-Hill, 2009**.** **[3]** R. E. Ziemer and W. H. Tranter, *Principles of Communications,* 7th Edition, Wiley, 2014.
Prepared by:	Ali Olfat
Date:	December 9, 2017.

*EE: Electrical Engineering		CE: Computer Engineering	
Com	Communications	SW	Software
E	Electronics	HW	Hardware
P	Power	IT	Information Technology
B	Bioelectronics		
Con	Control		
D	Digital System		