



**University of Tehran**  
**School of Electrical and Computer Engineering**

<b>Course:</b>	<b>8101100 – Data Transmission</b>									
<b>Course type:</b>	EE*						CE*			Credit: 3
	Com	E	P	B	Con	D	SW	HW	IT	
	Required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Elective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Level:</b>	Undergraduate <input checked="" type="checkbox"/> Graduate <input type="checkbox"/>									
<b>Co-requisite(s):</b>	None.									
<b>Prerequisite(s):</b>	Systems Analysis (8101144) - Computer Networks (8101412)									
<b>Prerequisite by topic:</b>	Basic probability, basic concepts in communications signals, systems, and components, including Fourier analysis									
<b>Textbook(s):</b>	[1] W. Stallings, <i>Data and computer communications</i> , 8th ed. Prentice Hall, 2004.									
<b>Coordinator:</b>	Khonsaari, Professor, School of ECE									
<b>Goals:</b>	This course is an introduction to the principles and practice of computer networking, emphasizing data and computer communications and the lower layers of the OSI and TCP/IP protocol architectures.									
<b>Outcome:</b>	<p>Upon successful completion of the course, students will be able</p> <ol style="list-style-type: none"> <li>1. Behavior of data signals propagated through a transmission medium, twisted pair, coaxial cable, optical fiber, and wireless (microwave radio and infrared);</li> <li>2. Distinction between digital and analog data; and digital and analog transmission;</li> <li>3. Asynchronous vs synchronous communication;</li> <li>4. Understanding Channel Capacity and Information Theory</li> <li>5. Datalink control protocols, the cooperative point-to-point exchange of data between two devices;</li> <li>6. Understanding Coding Theory and being familiar with important coding systems</li> <li>7. Error detection, error and flow control;</li> <li>8. Frequency-division multiplexing (FDM) and time-division multiplexing (TDM);</li> <li>9. Basic concepts of frame relay and cell relay networks (ATM);</li> <li>10. Traditional LANs, Ethernet and token ring;</li> <li>11. Spread Spectrum</li> </ol>									
<b>Topics:</b>	1 & 2 Intro to the principles of communication  Fourier Analysis									

Fourier Series Representation of Periodic Signals  
Fourier Transform Representation of Aperiodic Signals  
Decibels and Signal Strength

3. Data Transmission

- 3.1 Concepts and Terminology
- 3.2 Analog and Digital Data Transmission
- 3.3 Transmission Impairments
- 3.4 Channel Capacity

4. Guided and Wireless Transmission

- 4.1 Guided Transmission Media
- 4.2 Wireless Transmission
- 4.3 Wireless Propagation
- 4.4 Line-of-Sight Transmission

5. Understanding Channel Capacity and Information Theory

6. Signal Encoding Techniques

- 6.1 Digital Data, Digital Signals
- 6.2 Digital Data, Analog Signals
- 6.3 Analog Data, Digital Signals
- 6.4 Analog Data, Analog Signals

7. Digital Data Communication Techniques

- 7.1 Asynchronous and Synchronous Transmission
- 7.2 Types of Errors
- 7.3 Error Detection
- 7.4 Error Correction
- 7.5 Line Configurations

8. Coding Theory

- 8.1 Repetition Codes and Parity Codes
- 8.2 Linear Block Codes
- 8.3 CRC Codes
- 8.4 Convolutional Codes
- 8.5 Non-binary Codes (BCH Codes and Reed-Solomon Codes)

8. Data Link Control

- 8.1 Flow Control
- 8.2 Error Control
- 8.3 High-Level Data Link Control (HDLC)

9. Multiplexing

- 9.1 Frequency-Division Multiplexing
- 9.2 Synchronous Time-Division Multiplexing
- 9.3 Statistical Time-Division Multiplexing
- 9.4 Asymmetric Digital Subscriber Line
- 9.5 xDSL

	10. Spread Spectrum 10.1 The Concept of Spread Spectrum 10.2 Frequency Hopping Spread Spectrum 10.3 Direct Sequence Spread Spectrum 10.4 Code-Division Multiple Access  11. Wide Area Networks 11.1 Frame Relay 11.2 Asynchronous Transfer Mode
<b>Computer usage:</b>	Matlab (Simulink), Ns2
<b>Assignments:</b>	5 homework assignments
<b>Projects:</b>	2 course project
<b>Grading:</b>	Assignments: 15 % Projects: 10 % Midterm exam 1: 25 % Midterm exam 2: 25% Final exam: 25 %
<b>Further readings:</b>	[1] A. Bruce Carlson, P. Crilly, <i>Communication Systems</i> , 5 <sup>th</sup> ed. McGraw-Hill Education, 2009. [2] B.P. Lathi, <i>Modern Analog and Digital Communication Systems</i> , 3 <sup>rd</sup> ed. Oxford University Press, 1998. [1] John J. Proakis, <i>Digital Communications</i> , 4 <sup>th</sup> ed. McGraw-Hill, 2000.
<b>Prepared by:</b>	
<b>Date:</b>	

*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		