University of Tehran
School of Electrical and Computer Engineering

<table>
<tr><td>Course:</td><td colspan="10">8101172 – Coding Theory</td></tr>
<tr><td>Course type:</td><td colspan="10"><table>
<tr><td></td><td colspan="6">EE*</td><td colspan="3">CE*</td><td rowspan="2">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><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"></td></tr>
<tr><td>Prerequisite(s):</td><td colspan="10">Communications II (8101355)</td></tr>
<tr><td>Prerequisite by topic:</td><td colspan="10">Digital Communications Theory</td></tr>
<tr><td>Textbook(s):</td><td colspan="10">[1] S. Lin, and D.J. Costello, Jr., Error Control Coding: Fundamentals and Applications, Prentice-Hall, 2nd Edition, 2004.</td></tr>
<tr><td>Coordinator:</td><td colspan="10">Maryam Sabbaghian</td></tr>
<tr><td>Goals:</td><td colspan="10">The course is designed for graduate level. It provides mathematical background to understand, analyze and design linear block codes, convolutional codes, low density parity check codes and turbo codes.</td></tr>
<tr><td>Outcome:</td><td colspan="10">Upon successful completion of the course, students will be able to
1. obtain an overview on how coding techniques can improve the performance of communications systems.
2. acquire fundamental knowledge regarding mathematical background of different coding techniques.
3. analyze and design linear block codes.
4. obtain knowledge about specific cyclic codes and their decoding schemes.
5. analyze convolutional codes and perform several decoding schemes for this category of codes.
6. acquire knowledge regarding iterative decoding schemes for both block codes and convolutional codes.
7. analyze and compare existing decoding algorithms.</td></tr>
<tr><td>Topics:</td><td colspan="10">1- Linear algebra, Groups, Fields, Vector spaces.
2- Linear block codes.
3- Cyclic codes.
4- BCH codes.
5- Reed-Solomon codes.
6- Convolutional codes.
7- Maximum likelihood decoding of convolutional codes.
8- BCJR algorithm.
9- Turbo codes.</td></tr>
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	10- LDPC codes.
Computer usage:	MATLAB
Assignments:	8 problem sets
Projects:	Term paper
Grading:	Assignments 10% Term paper 5% Midterm exam 35% Final exam 50%
Further readings:	[1] T. K. Moon, *Error Correction Coding Mathematical Methods and Algorithms,* Wiley, 2005. [2] T. Richardson, R. Urbanke, *Modern Coding Theory,* Cambridge University Press, 2007. [3] S. J. Johnson, Iterative Error Correction: Turbo, Low-Density Parity-Check and Repeat-Accumulate Codes, Cambridge University Press, 2009.
Prepared by:	Maryam Sabbaghian
Date:	Dec., 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		