University of Tehran
School of Electrical and Computer Engineering

<table>
<tr><td>Course:</td><td>8101237 –Nonlinear Control</td></tr>
<tr><td>Course type:</td><td>
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<tr><td></td><td colspan="6">EE*</td><td colspan="3">CE*</td><td rowspan="2">Credit: 1</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>Undergraduate ☐
Graduate ■</td></tr>
<tr><td>Co-requisite(s):</td><td>None.</td></tr>
<tr><td>Prerequisite(s):</td><td>None.</td></tr>
<tr><td>Prerequisite by topic:</td><td>Modern control theory</td></tr>
<tr><td>Textbook(s):</td><td>[1] Nonlinear Systems, by: H. K. Khalil; Prentice Hall, 3rd edition, 2001
[2] Applied Nonlinear Control, by: J. J. Slotine and W. Li; Prentice Hall; 1st edition, 1990
[3] Nonlinear Systems Analysis, by: M. Vidyasagar; Prentice Hall, 2nd edition, 1992
[4] Nonlinear Control Systems, by: A. Isidori; Springer Verlag; 3rd edition, 1997</td></tr>
<tr><td>Coordinator:</td><td>Yazdanpanah, Professor, School of ECE</td></tr>
<tr><td>Goals:</td><td>To familiarize the audience with different techniques of analysis and synthesis of nonlinear control systems.</td></tr>
<tr><td>Outcome:</td><td>Upon successful completion of the course, students will be able to
1. Evaluate the existence, uniqueness and properties of solutions of an ODE
2. Derive and analyse the linear model of a nonlinear system
3. Analyse the stability properties of linear and nonlinear autonomous systems
4. Analyse the stability properties of linear and nonlinear non-autonomous systems
5. Design local, semi-global and global controllers for nonlinear systems</td></tr>
<tr><td>Topics:</td><td>1) Properties of ODEs solutions
2) Phase-plane analysis
3) Limit cycles
4) Lyapunov theory for autonomous/non-autonomous systems
5) Domain of attraction and its importance in design
6) Multivariable circle criterion
7) Multivariable Popov criterion</td></tr>
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	8) Describing function method 9) Design of local controllers for nonlinear systems 10) Feedback linearization (I/S and I/O) 11) Disturbance decoupling, non-interacting control, backstepping, and sliding-mode technique 12) New (applied/theoretical) emerging topics will be covered in the final projects.
Computer usage:	MATLAB
Assignments:	4 to 6 homework assignments
Projects:	None.
Grading:	Assignments: 25 % Midterm exams: 40 % Final exam: 35 %
Further readings:	
Prepared by:	Yazdanpanah, Professor, School of ECE
Date:	23 August 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		