University of Tehran
School of Electrical and Computer Engineering

<table>
<tr><td>Course:</td><td>8101494 –Robust 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] Linear Optimal Control: H2 and H-infinity Methods, by: Jeffrey B. Burl; Prentice Hal, 1999
[2] A Course in H-infinity Control, by: B. Francis; Lecture Notes in Control and Information Sciences, Vol. 88, Springer-Verlag, Berlin, 1987
[3] Linear Robust Control, by: M. Green and D.J.N. Limebeer; Prentice Hall, 1995
[4] Multivariable Feedback Control, by: S. Skogestad and I. Postlethwaite; John Wiley & Sons, Inc., 1996
[5] Robust and Optimal Control, by: K. Zhou, J.C. Doyle and K. Glover; Prentice Hall, 1996</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 robust control systems in the frequency and time domains.</td></tr>
<tr><td>Outcome:</td><td>Upon successful completion of the course, students will be able
1. Analyze the robustness of a control system
2. Design robust controllers in frequency domain
3. Design robust controllers in time domain
4. Solve HJI equation for nonlinear robust control problems</td></tr>
<tr><td>Topics:</td><td>1) Sensitivity issues in control systems synthesis
2) Norms in frequency and time domains
3) L2, L-infinity, H2, and H-infinity spaces in frequency and time domains
4) Non-minimum phase and unitary systems
5) Internal stability and Small gain theorem
6) Coprime factorization and Bezout identity
7) Weighted sensitivity minimization problem and its solution</td></tr>
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	8) Model matching problem and its solution 9) Hankel operator, Nehari problem and its solutions 10) Nevanlima-Pick problem and its solution 11) Spectral factorization and LFM 12) Two-block problem 13) Full information control and differential games 14) Riccati differential equation and the corresponding Hamiltonian system 15) H-infinity estimation 16) H-infinity control using output feedback 17) Structured Singular Values and stability robustness 18) Performance Robustness Analysis using SSV 19) Mu synthesis 20) 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		