University of Tehran
School of Electrical and Computer Engineering

<table>
<tr><td>Course:</td><td>8101306 –Optimal 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] Optimal Control Theory, by: D. E. Kirk; Prentice Hall, 1970
[3] Linear Optimal Control Systems, by: H. Kwakernaak and R. Sivan; Wiley, 1972
[4] Optimal Control: Linear Quadratic Methods, by: B.D.O. Anderson and J.B. Moor; Prentice Hall, 1990</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 synthesis of optimal control systems.</td></tr>
<tr><td>Outcome:</td><td>Upon successful completion of the course, students will be able
1. Design LQ regulators for finite/infinite horizons
2. Design stochastic regulators for finite/infinite horizons
3. Design optimal (in H2 sense) state estimators
4. Design LQG regulators
5. Do the loop transfer recovery for enhancement of LQG designs
6. Solve HJB equation for nonlinear optimal control problems</td></tr>
<tr><td>Topics:</td><td>1) Calculus of Variations
2) Pontryagin's Minimum Principle, and Bellman's Principle of Optimality
3) Orthogonal Projection
4) Riccati differential equation and Hamiltonian system
5) Linear quadratic regulator (finite/infinite horizon)
6) Stochastic regulator (finite/infinite horizon) and its relation to H2 optimal control
7) Kalman Filter (finite/infinite horizon)
8) Linear quadratic Gaussian</td></tr>
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	9) Feedforward and Integral control 10) Robustness of optimal control strategies 11) Loop transfer recovery 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		