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| **Adama Science and Technology University**  **School of Electrical Engineering and Computing**  **Department of Electrical Power and Control Engineering** | | | | | | |
| Course Code | PCE 6302 | | | | | |
| Course Title | Optimal and Adaptive Control Systems | | | | | |
| Degree Program | MSc in Electrical Power and Control Engineering (Control) | | | | | |
| Credits | 3 | | | | | |
| Contact Hours/week | Lecture | | Tutorial | | Practice/Laboratory | |
|  | 2 | | * none - | | * none - | |
| Course Instructor (s) |  | | | | | |
| Address | Building: Rm 606 <Tel:+251> 99 480 7269 E-mail: snkim0701@daum.net | | | | | |
| Course Objectives: Upon successful completion of the course, students will be able  To familiarize students with the applications of optimization necessary and sufficient conditions  To analyze optimal problem without and with constrains  To familiarize to design optimal Linear Quadratic Regulator problems   To familiarize to design optimal Linear Quadratic Gaussian problems | | | | | | |
| **Course Description/Course Contents**  **Basic** **Linear Algebra**: Vector pace, eigen-values and eigen-vectors for finite and infinite dimensional space,  Independent , orthogonal vectors, positive symmetric matrix, singular value decomposition.  **Optimization:** static parameter optimization without constraints and with constraints(Laglange multiplier), dynamic parameter optimization without constraints and with constraints(Euler conditions, Hamiltonian equation, Hamiltonian-Jacobian-Bellman sufficient and necessary conditions for the optimality)  **LQR:** Linear Quadratic Regulator optimal problems, continuous and discrete Riccati equations, Transient  behavior and steady state analysis.Optimal closed loop system performance analysis, cheap control respect to the weighting for control input.  **LQG:** stochasticlinear system analysis, Linear Quadratic Gaussian optimal estimator and optimal controller design and analysis, Separation Principle design  **Adaptive control:** Parameter identification, sub-optimal design for non-linear stochastic Gaussian system, | | | | | | |
| NB ! Latest/recent developments regarding the specified course applications can be incorporated. | | | | | | |
| Pre-requisites | Linear algebra, differential equation | | | | | |
| Semester |  | | | | | |
| Status of Course | Major Mandatory | | | | | |
| Teaching & Learning  Methods | Lecture supported by Computer exercises using MATLAB | | | | | |
| Assessment/Evaluation |  | **Measurement** | | **Value/Mark (%)** | |  |
| Attendance | | 10% | |
| 2 Assignments  2 Test  Mid-Exam  Examination (final)  **Total** | | | 10%  20%  20%  40%  **100%** | | |
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| Attendance  Requirements | Minimum 80% during lecture except for some unprecedented mishaps | | | | | |
| Textbooks and References   1. Gilbert Strang, “Differential Equations and Linear Algebra”,Wellesley-Cambridge Press. 2014 2. Arthur E. Bryson, “Applied Optimal Control, Estimation ,and Control”,Hemisphere Publishing Corporation., 1975 3. Kwakernak, “Linear Optimal Control Systems”, Wiley-Interscience,1972 4. S.Kim, “https://github.com/snkim0701/Optimal Adaptive Control” 5. Lecture 4, “HLB Equtions”, <https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-323-principles-of-optimal-control-spring-2008/lecture-notes/lec4.pdf> 6. Lecture 5, “Calculus of Variation”, <https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-323-principles-of-optimal-control-spring-2008/lecture-notes/lec5.pdf> | | | | | | |