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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 6205 | | | | | |
| Course Title | Stochastic model, estimation & control | | | | | |
| Degree Program | MSc in Electrical Power and Control Engineering (Control) | | | | | |
| Credits | 3 | | | | | |
| Contact Hours/week | Lecture | | Tutorial | | Practice/Laboratory | |
|  | Tuesday | | Wednesday | | * none - | |
| Course Instructor (s) |  | | | | | |
| Address | Building: Rm 605 /099-480-7269 E-mail: snkim070155@gmail.com | | | | | |
| Course Objectives: Upon successful completion of the course, students will be able  To familiarize students with the applications of **stochastic** processes in engineering  To analyze random processes and its application in signal processing, in **control** systems  To familiarize with **Gauss Markov** processes  To model and analyze disturbances and measurement noises in a system | | | | | | |
| **Course Description/Course Contents**  **Basic** **Probability** **Theory:** Set Theory, Probability Space, the Probability Measure, Sigma algebra, Key Concepts in Probability Theory (Conditional Probability, Bayes’ rule).  **Random Variables and Stochastic Processes:** CDF,PDF, Expectation and Moments of RVs, Characteristic Functions, Conditional Expectation and Probability, Gauss-Markov(GM) Stochastic Processes.  **Kalman filtering:**  Minimum Variance Estimation, Maximum Likelihood Estimation, Least Square and Orthogonal Projection to Kalman Filter.  **Stochastic Calculus:** Wiener Integral, Ito integral, Ito stochastic differentials, Continuous-Time GM Process  **Continuous time GM Systems:** Kalman-Bucy Filter, Riccati Equation, Power spectral Densities  **Stochastic Control**: linear quadratic gaussian control problem, Dynamic Programming for continuous-time GM Process  **Non-linear Kalman Filter:** Extended Kalman Filter, non-linear transform, Unscented Kalman Filter | | | | | | |
| NB ! Latest/recent developments regarding the specified course applications can be incorporated. | | | | | | |
| Pre-requisites | **Probability and Random variables / real analysis** | | | | | |
| 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/1 Test**  **Mid-Exam**  **Final.Exam**  **Total** | | | **30%**  **20%**  **40%**  **100%** | | |
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| Attendance  Requirements | Minimum 80% during lecture except for some unprecedented mishaps | | | | | |
| Textbooks and References   1. J.L.Speyer, W.H.Chung, ”Stochastic Processes, Estimation and Control”. SIAM, 2008. 2. G.Strang, ”Differential Equations and Linear Algebra”,2014. 3. Peter S.MayBeck, ”Stochastic models, estimation, and control” Vol.1,1979 4. <https://github.com/snkim0701/Stochatic> | | | | | | |