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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 | |
|  | 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 **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, IPython(**Jupyter Notebook**), | | | | | |
| Assessment/Evaluation |  | **Measurement** | | **Value/Mark (%)** | |  |
| **Attendance** | | **10%** | |
| **2 Assignments/**  **1 Test**  **Mid-Exam**  **Examination (final)**  **Total** | | | **20%(B&A Mid Exam)**  **10%(Dec.18)**  **20%(Nov.18)**  **40%(Jan.06)**  **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. Papoulis, A, and Pillai, S.U., “Probability, Random Variables and Stochastic Processes, 3th Edition”,   McGraw Hill, 2005   1. H.L.Royden, ”Real Analysis”, The Macmillan Company, 1967. 2. G.Strang, ”Linear Algebra and Its Application”, Harcourt Brace Jovanovich,3rd ed.,1988. 3. R.R.Labbe Jr, ”Kalman and Bayesian Filters in Python”, <https://github.com/rlabbe/Kalman-and-Bayesian-Filters-in-Python>, 2018 4. <https://github.com/snkim0701/Stochatic> | | | | | | |