

Roll No .....

**MEIC - 203**

**M.E./M.Tech., II Semester**

Examination, June 2016

**State Estimation and System Identification**

**Time : Three Hours**

**Maximum Marks : 70**

- Note :** i) Attempt any five questions.  
ii) All questions carry equal marks.

1. a) Enumerate and briefly describe three basic problems of system theory.  
b) Define and differentiate the terms of system identification and parameter estimation.
2. a) Draw the block diagram for optimal state estimation in linear stationary systems.  
b) Describe the complex-valued case of Wiener filter.
3. a) Draw the block diagram of the covariance estimate and gain computation for the Kalman-Bucy filter.  
b) Describe the concepts of full and reduced order observers for linear and non-linear systems.
4. Consider a battery with a completely unknown voltage ( $P_0 = \infty$ ). Two independent measurements of the voltage are taken to estimate the voltage, the first with a variance of 1, and the second with a variance of 4.  
a) Write the weighted least squares voltage estimate in terms of the two measurements  $y_1$  and  $y_2$ .

- b) If weighted least squares is used to estimate the voltage, what is the variance of voltage estimate after the first measurement? What is the variance of the voltage estimate after the second measurement?
5. State and explain the modern techniques of system identification.
6. Investigate the effects of non-ideal input in an impulse response test by plotting the response of the system with impulse response  
 $g(t) = \exp(-t) - \exp(-5t)$   
to a rectangular pulse input of unit area and duration  
i) 0.1  
ii) 0.2 and  
iii) 0.5
7. a) Explain a generalized quasi-linearization method for second order system.  
b) Describe Kiefer-Wolfowitz algorithm for estimating the maximum of a function.
8. Write short notes on any two of the following:  
a) Cost function for system identification  
b) Correlation techniques  
c) Non-linear estimation techniques

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