Electical Engineering Department
EEL774 Parameter Estimation and System Identification
Major Test            Date 5-5-09

Time allowed – Two hours.      Full marks – 40

Answer all questions

Q.1 Consider a non-linear differential equation
$$\ddot{x} + a(1-x^3)\dot{x} + bx = 0$$
Where 'a' and 'b' are unknown parameters to be estimated.
Design an experiment to identify 'a' and b using quasi-linearization method.            – 8 Marks

Q.2. For the Kalman filter problem find the expression for error Covariance matrix $P(k|k)$ in terms of $P(k|k-1)$.  – 4 Marks

Q.3 Describe a method for identification of the transfer function $G(s,\tau)$ of the time-varying system.         – 4 Marks

Q4 Consider a scalar non-linear differential equation model of a system. The record of input and output of the system is given.
Use Laguerre-polynomial approach to estimate parameters of the system recursively.           – 8 Marks

Q.5. Consider a scalar linear differential equation model of a system. The record of input and output of the system is given. Use any Hermite orthogonal polynomial approach to estimate parameters of the system recursively.           – 8 Marks.

Q.6 Consider a system described by
$$A^*(z^{-1})y(k) = B^*(z^{-1})U(k) + \varepsilon_k, \text{ where } A^*(z^{-1}), B^*(z^{-1}), y(k)$$
$U(k)$ and $\varepsilon_k$ have usual meanings.           8 Marks