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SEAT No. :

P3896

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M.E. (Electrical) (Control Systems)

SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL

(2017 Course) (Semester - III) (603102)

Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

1) ***Answer Qu 1 or 2, Qu 3 or 4, Qu 6 or Qu 7, Qu 5 is compulsory.***
2) ***Figures to the right side indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of algorithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam table is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain the parametric and non parametric methods of system identification. **[4]**

b) Compute the QR factorization of matrix: $\begin{bmatrix} 12 & 27 \\ 4 & 2 \\ 6 & 10 \end{bmatrix}$ **[5]**

OR

Q2) a) Derive least square estimate of θ for model given by $y = \Phi\,\theta$ **[5]**

b) What is the importance of persistently exciting input signal in system identification? What order of p.e. is white noise? **[4]**

Q3) Write short notes on any three: **[9]**

a) Instrumental variable method

b) Recursive estimation

c) Pattern recognition

d) Bayesian learning

e) Maximum likelihood method

f) Model structure

OR

P.T.O.

Q4) a) Prove the matrix inversion lemma: $[A+BCD]^{-1}=A^{-1}A^{-1}B[C^{-1}+DA^{-1}B]^{-1}DA^{-1}$. **[4]**

b) With the help of block diagram explain 'self tuning regulator'. **[5]**

Q5) a) Write short note on. **[8]**

i) MIT rule

ii) Kalman filter as a state estimator

b) What are various adaptive schemes and how they are implemented? **[8]**

Q6) With the help of both MIT rule and Lyapunov theory, design an MRAS for system described by $G(s)=\frac{b}{s+a}$ where a and b are unknown. The controller is given by $u(t)=\theta_1 u_c(t)+\theta_2 y(t)$ and the desired closed loop model is $\frac{dy_m}{dx}=-a_m y_m+b_m u_c$. Draw simulation diagram and compare two methods.

Assume $V(\theta)=\frac{1}{2}\left[e^2+\frac{1}{b\gamma}(b\theta_2+a-a_m)^2+\frac{1}{b\gamma}(b\theta_1-b_m)^2\right]$ **[16]**

OR

Q7) Consider a position servo described by $\frac{dv}{dt}=-av+bu$ and $\frac{dy}{dt}=v$; where a and b are unknown. Assume the control law $u=\theta_1(uc-y)-\theta_2 v$ is used and that it is desired to control the system in such a way that the transfer function from command signal to process output is given by $G_m(S)=\frac{w^2}{s^2+2\xi ws+w^2}$ determine an adaptive control law that adjusts the parameters so that the desired objective is obtained. **[16]**

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