

R07

Code: R7411304

B.Tech IV Year I Semester (R07) Supplementary Examinations, May 2013

ADAPTIVE CONTROL SYSTEMS
(Electronics and Control Engineering)

Time: 3 hours

Max. Marks: 80

Answer any FIVE questions
All questions carry equal marks

- 1 (a) Explain about:
 - (i) Gain scheduling adaptive control.
 - (ii) Model reference adaptive control.
 (b) Explain effects of process variations.

- 2 (a) Obtain the least squares estimate to minimize least square loss function.
 (b) Explain about stochastic approximation algorithm.
 (c) Obtain convergence rate for the data generated by $y(t) + ay(t - 1) = bu(t - 1) + e(t)$ with a feed back of form $u(t) = -k \left[1 + \frac{u(t)}{\sqrt{t}} \right] y(t)$; $u(t)$ is a sequence of independent RV's that are also independent of $\{e(t)\}$.

- 3 (a) Draw and explain self tuning regulator.
 (b) Consider the process $G(S) = \frac{1}{S(S+a)}$; a is unknown parameter. Assume desired closed loop system is $G_m(S) = \frac{\omega^2}{S^2 + 2\zeta\omega S + \omega^2}$ construct continuous and discrete time indirect self tuning algorithms for the systems.

- 4 (a) Explain how LQG controller can be interpreted as pole placement design.
 (b) Apply the linear quadratic design procedure for the process model $A(q)y(t) = B(q)u(t) + c(q)e(t)$ and obtain LQG solution and discuss how this can be interpreted as pole placement control.

- 5 (a) Explain about Lyapunov theory for time invariant systems (definitions and theorems).
 (b) Show that the transfer function $G(S) = \frac{1}{S+1}$ is SPR and OSP but not ISP.

- 6 (a) Explain about relations between MRAS and STR.
 (b) Write down steps required for the derivation of MRAS. Write design parameters.
 (c) What is celebrated MIT rule?

- 7 (a) Write about:
 - (i) PID control.
 - (ii) Auto tuning technique.
 (b) Consider the process described by transfer function $G(S) = \frac{K}{S} e^{-SL}$. Determine a proportional regulator that gives an amplitude margin $A_m = 2$. compare the results by applying the Ziegler Nichols rule.

- 8 (a) Analyze the gain schedule for the tank system with cross section A and height 'h'.
 (b) Explain the method of nonlinear transformation of second order system.
 (c) List out general ideas to design gain scheduling controllers.
