F.Y.M.Tech

COLLEGE OF ENGINEERING, PUNE

(An autonomous Institute of Government of Maharashtra)

END-SEMESTER EXAMINATION

Modern Control Theory

Programme: F.Y.M.Tech. (Instrumentation & Control) Year: 2013-14
Duration: 3.00 Hours Max. Mark: 60

Instructions to candidates:

1. All questions are compulsory.
2. Neat diagrams must be drawn wherever necessary.
3. Figure to the right indicate full marks.

Q. 1 A unity feedback system with OLTF **(12)**

$$G(s) = \frac{K}{s(0.25s+1)(0.1s+1)}$$

Design compensator to meet following specifications:(Use Bode plot)

(a) Velocity error constant $K_v \geq 25 \quad sec^{-1}$

(b) $PM \geq 40^o$

Q. 2 (a) Given **(6)**

$$A = \begin{bmatrix} 0 & 2 \\ -2 & -4 \end{bmatrix}$$

Compute e^{At} using Calay Hamilton theorem.

(b) Realize the following TF using Companion-II form **(6)**

$$G(s) = \frac{(s^+s+1)}{s^2(s+10)(s+11)}$$

Q. 3 A unity feedback system with OLTF **(12)**

$$G(s) = \frac{100}{s(s+5)(s+10)}$$

Design compensator by using root locus method to meet:

(a) the response of CLTF w.r.t step input has no more than 20% overshoot and two fold improvement in settling time.

(b) the steady state error w.r.t. ramp input is no more than 0.5

Q. 4 A unity feedback system with OLTF **(12)**

$$G(s) = \frac{9}{(s^2-9)}$$

(a) Find (A,b,c) for this system in observable canonical form.

(b) Design a state feedback controller k where $u = -kx$ which will place the closed loop poles at $-3 \pm j3$.

(c) Design observer such that observer poles are located at $-6 \pm j6$.

Q. 5 A unity feedback system with OLTF **(12)**

$$G(s) = \frac{1}{s(s+1)}$$

For a sampling period $T = 0.2$ sec, Convert system to discrete-time model and draw root locus for the same. Design lead controller for the system so that $\zeta = 0.5$ and $\omega_n = 4.5$.