COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

(EE(DE)-14007) Control System II

Course: B.Tech Branch: Electrical Engineering

Semester: Sem VII

Year: 2014-2015 Max.Marks:60

Duration: 3 Hours Time:- ---2.00 PM-5.00PM **Date:---Nov. 30, 2014**

Instructions: Solve all the questions **MIS No.** | | | | | | | | | |

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of anything like stationery, calculator is not allowed.
5. Assume suitable data if necessary.
6. Write your MIS Number on Question Paper

Q. 1 (a) Given a unity feedback system having open loop transfer function as below: 06

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

Design a suitable compensating R-C network in cascade to get PM=45, and steady state error for step input to be less than 1/15

(b) Design a suitable compensator to yield Mp ≤40% and ts ≤ 5 for unity feedback system having open loop transfer function 06

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

Q. 2 (a) Design a suitable compensator to get PM=40 degrees and Kv ≤10. For the system having following open loop transfer function. 08

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

(b) Realize the compensator designed in (Q.2a). 04

Q. 3 (a) Design a PID Controller for the system having an open-loop transfer function of

$$G(s)=\frac{1}{(0.1s+1)(0.2s+1)^2}$$

04

(b) Design PI Controller to meet Mp=25% and ts=3 Sec. for the unity feedback plant with open loop transfer function

08

$$G(s)=\frac{k}{s(s+40)}$$

Q. 4 (a) Determine 'a' and 'b' so that the system given below is controllable and observable.

06

$$\dot{x}=\begin{pmatrix}0 & a\\ -2 & b\end{pmatrix}x+\begin{pmatrix}0\\ 1\end{pmatrix}u \quad and \quad y=\begin{pmatrix}1 & 0\end{pmatrix}x$$

(b) Design a state feedback controller for the system given below to have closed loop poles at -1 and -2. Design necessary observer.

06

$$\dot{x}=\begin{pmatrix}-1 & 0\\ 0 & 3\end{pmatrix}x+\begin{pmatrix}0\\ 1\end{pmatrix}u \quad and \quad y=\begin{pmatrix}1 & 0\end{pmatrix}x$$

Q. 5 (a) What is backlash? How the system performance is affected due to this nonlinearity?

04

(b) Sketch the phase portrait of following systems

04

(i) $\dot{x}=\begin{pmatrix}-8 & 6\\ 0 & -2\end{pmatrix}x$ (ii) $\dot{x}=\begin{pmatrix}4 & -4\\ 4 & 4\end{pmatrix}x$

(c) Comment on degrees of freedom of PI-D controller.

04