



Reg. No. :

Name :

First Semester M.Tech. Degree Examination, March 2014
(2013 Scheme)

Branch : Electrical and Electronics Engineering
Streams Control Systems, Power Control and Drives, Guidance and
Navigational Control, Electrical Machines, Power System Control,
Industrial Instrumentation and Control
ECC 1003 : DYNAMICS OF LINEAR SYSTEMS

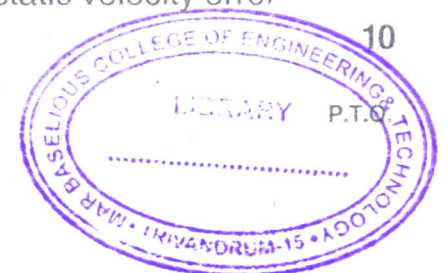
Time : 3 Hours

Max. Marks : 60

Instructions : 1) Answer **any two** full questions from **each** Module.
2) **Each** full question carry **10** marks.

MODULE – 1

1. a) Realize an analog lag compensator using operational amplifiers. 3
b) Design a suitable compensator for a unity feedback system $\frac{k}{s(s+1)(s+5)}$ such that it meets the following specifications. $W_n = 3.5$ rad/sec, $\delta = 0.45$, $k_v > 30$ s⁻¹. 7
2. a) Give the design steps for the lead compensation design using frequency response. 3
b) Design a suitable compensator for a unity feedback system $\frac{10}{s(s+1)}$ such that the closed loop system will satisfy the requirements $k_v = 20$ s⁻¹, phase margin = 50° and gain margin ≥ 10 dB. 7
3. Consider a unity feedback control system whose feed forward transfer function is given by $G(s) = \frac{10}{s(s+2)(s+8)}$. Design a compensator such that the dominant closed loop poles are located at $s = -2 \pm j2\sqrt{3}$ and the static velocity error constant k_v is equal to 80 sec⁻¹. 10





MODULE – 2

4. a) How can the effect of constant disturbance vector be eliminated using Integral error feedback ? 3
- b) Obtain the controllable sub realization of the system represented by
- $$\dot{x} = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix} x + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$$
- 7
5. Given a unity feedback system with an open loop transfer function $H(s) = \frac{1}{s(s-2)}$. Design a cascade compensator so that the overall transfer function has the form $H_0(s) = \frac{\beta(s)}{(s+1)^2}$, where $\deg \beta(s) \leq 2$. 10
6. a) Obtain the Bass-Gura formula for the state feedback gain. 5
- b) Explain the difference between :
- i) Controllability and Reachability.
 - ii) Stabilizability and Detectability. 5

MODULE – 3

7. Consider the system defined by

$$\dot{x} = Ax + Bu$$

$$y = Cx$$

where $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -5 & -6 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ $C = [1 \ 0 \ 0]$.

Design a full order observer, assuming that the desired poles for the observer are located at $s = -10$, $s = -10$, $s = -15$. 10

8. Explain the procedure to obtain the controllable companion and observable companion form for a MIMO system. 10
9. a) Obtain the transfer function of a combined observer – controller compensator. 5
- b) Explain in detail the separation property of the observer – controller design procedure. 5