EE-E

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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 $\dfrac{k}{s(s+1)(s+5)}$ 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 $\dfrac{10}{s(s+1)}$ 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 $G(s) = \dfrac{10}{s(s+2)(s+8)}$. 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

P.T.O.

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
