B.TECH SEM – V (2007 COURSE) (ELECTRICAL ENGG.) :
WINTER - 2017

SUBJECT : LINEAR CONTROL SYSTEM

Day : **Thursday**
Date : **11/01/2018**

Time : **02.30 PM TO 05.30 PM**
Max. Marks : 80

W-2017-2459

N.B.:

1) **Q.No.1** and **Q.No.5** are **COMPULSORY**. Out of the remaining questions attempt **ANY TWO** questions from each section.
2) Answers to both the sections should be written in the **SEPARATE** answer books.
3) Draw neat and labeled diagrams **WHEREVER** necessary.
4) Use of non programmable **CALCULATOR** is allowed.
5) Figures to the right indicate **FULL** marks.
6) Assume suitable data if necessary.

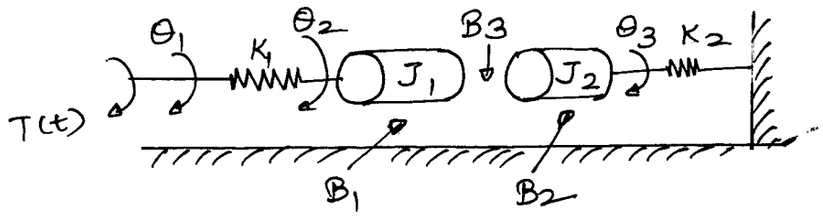
SECTION – I

Q.1 **a)** Derive transfer function of armature control DC servomotor. **[06]**

b) Find C(t) for unit step input when $0 < \xi < 1$. Sketch location of roots and response for $\frac{C(s)}{R(s)} = \frac{\omega_n^2}{s^2 + 2\xi\omega_n s + \omega_n^2}$. **[04]**

c) Find C(t) for $\xi = 0$ in above case and sketch location of roots and response. Comment about stability. **[04]**

Q.2 **a)** For the system shown in figure. Write down performance equations and draw analogous electrical network using force voltage analogy. **[08]**



b) Draw neat block diagram of radar antenna position control system and explain function of each block. **[05]**

Q.3 **a)** A feedback system is described by following transfer function $G(s) = \frac{16}{s^2 + 4s + 16}$ $H(s) = Ks$. **[08]**
The damping factor of the system is 0.8. Determine overshoot, settling time and steady state error for unit step input. Sketch response.

b) Describe the effect of gain control on the system response. **[05]**

P.T.O.

Q.4 **a)** A unity feedback control system has $G(s)=\frac{k}{s(s+1)(s+5)}$. Sketch the root locus and find the value of k for which system becomes unstable. Draw a line for ξ= 0.5. **[08]**

b) Test the stability of the system using Routh's Hurwitz criteria, whose characteristics equation is $s^4+4s^3+7s^2+16s+12=0$. **[05]**

SECTION – II

Q.5 **a)** State mapping theorem and Nyquist stability criterion. **[04]**

b) Draw phase Bode plot and determine phase crossover frequency for **[06]**

$$G(s)=\frac{k}{s(s+1)(s+10)}$$

c) Compare lead and lag compensator. **[04]**

Q.6 **a)** For $G(s)=\frac{100}{s(s+8)}$ and $H(s)=1$, find resonant peak, resonant frequency and phase shift at resonant frequency. **[06]**

b) Find the stability of the system with given transfer function using Nyquist plot. **[07]**

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

Q.7 Draw Bode plot, find G.M. and P.M. and comment on the stability for the given system $G(s)=\frac{1000(1+0.2s)}{s(1+0.1s)}$. **[13]**

Q.8 **a)** Derive transfer function of lag compensator and sketch its bode plot. Show the frequency at which maximum phase angle is provided and write down expression. **[06]**

b) Explain the design procedure of lag compensator. **[07]**

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