B.Tech Sem – V (2007 Course) (Electrical Engg.) : WINTER - 2018

SUBJECT: LINEAR CONTROL SYSTEMS

Day: Thursday
Date: 22/11/2018

W-2018-2802

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

N.B.:

1) **Q. No. 1** and **Q. No. 5** are **COMPULSORY**. Out of remaining attempt **ANY TWO** questions from Section – I and Section – II.
2) Figures to the right indicate **FULL** marks.
3) Answers to both the sections should between in **SEPARATE** answer books.
4) Draw neat and labeled diagrams **WHEREVER** necessary.
5) Assume suitable data, if necessary.

SECTION - I

Q.1 **a)** Define open loop and close loop systems. Also write its advantages and disadvantages. **(05)**

b) Using Routh's criterion determine the stability of the system whose characteristics equation is $s^4+8s^3+18s^2+16s+5=0$ **(05)**

c) How the system is classified depending on the value of damping? **(04)**

Q.2 **a)** For a unity feedback control system then open loop transfer function: **(07)**

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

Find:

i) Position velocity and acceleration error constants.
ii) The steady state error when the input is R(s) where

$$R(s)=\frac{3}{s}+\frac{2}{s^2}+\frac{1}{3s^3}$$

b) Derive PD and PID controllers. **(06)**

Q.3 **a)** The closed loop transfer function of a unity feedback control system is given by $\frac{C(s)}{R(s)}=\frac{10}{(s^2+4s+5)}$ **(06)**

Determine:

i) Damping ratio
ii) Natural undamped resonance frequency
iii) Percentage peak overshoot
iv) Expression for error response.

b) A feedback control system is described as **(07)**

$$G(s)=\frac{50}{s(s+2)(s+5)}, \qquad H(s)=\frac{1}{s}$$

For a unit step input determine the steady state error constants and errors.

Q.4 **a)** Sketch the root locus for the open loop transfer function of unity feedback control system given below: **(07)**

$$G(s)\,H(s)=\frac{K}{s(s+1)(s+2)}$$

b) Discuss how root locus changes its shape by adding poles and zeros and also discuss its effect on stability. **(06)**

P.T.O.

SECTION - II

Q.5 **a)** Define: **(05)**
i) Resonant peak
ii) Resonance frequency
calculate its value for the system having

$$G(s)=\frac{25}{s^2+4s+25}$$

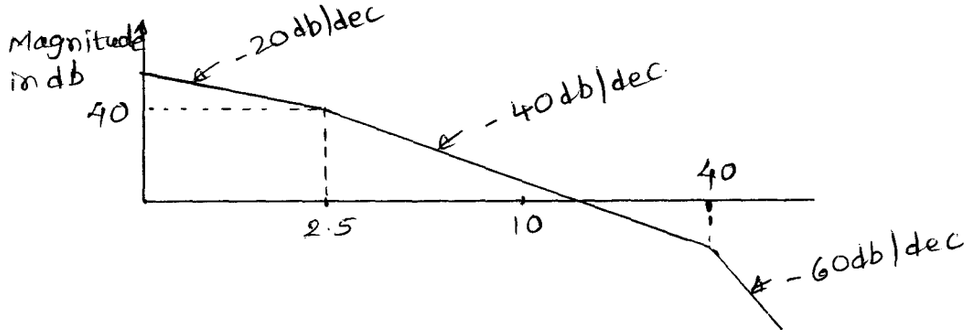
b) Sketch polar plot of $\frac{10}{(s+1)(s+2)}$ **(04)**

c) What is the effect of lag compensator on system performance? **(05)**

Q.6 A system has $G(s)H(s)=\frac{10}{(s+1)(s+2)(s+3)}$ **(13)**

Sketch Nyquist plot of the system.
Determine GM, PM and comment about stability.

Q.7 **a)** Identify transfer function from the given bode plot: **(08)**



b) Define gain margin and phase margin from sketch of bode plot and comment about stability. **(05)**

Q.8 **a)** Sketch bode plot of lead compensator and derive relation of maximum phase angle. **(07)**

b) Write stepwise procedure for design of lead compensator using bode plot. **(06)**

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