Total No. of Printed Pages:3

SUBJECT CODE NO:- P-65
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E.(EEP/EE/EEE) Examination May/June 2017
Control System Engineering
(Revised)

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B i) Attempt any three questions from each section.
ii) Q.no.1 & Q.no.6 are compulsory.
iii) Solve any two questions from remaining from each section.

Section A

Q .1 Solve any five. 10

a)Give the important features of feedback.
b)Give the advantages of open loop system.
c)What is time variant & time invariant?
d)List the steps to reduce the block diagram.
e)Define self loop and loop gain.
f)What is difference between type & order of system?
g)What is acceleration error coefficient?
h)Define Rise time and settling time.

Q.2 a) Obtain the close loop transfer function C(S)/R(S) of the system as shown in fig 1. 08

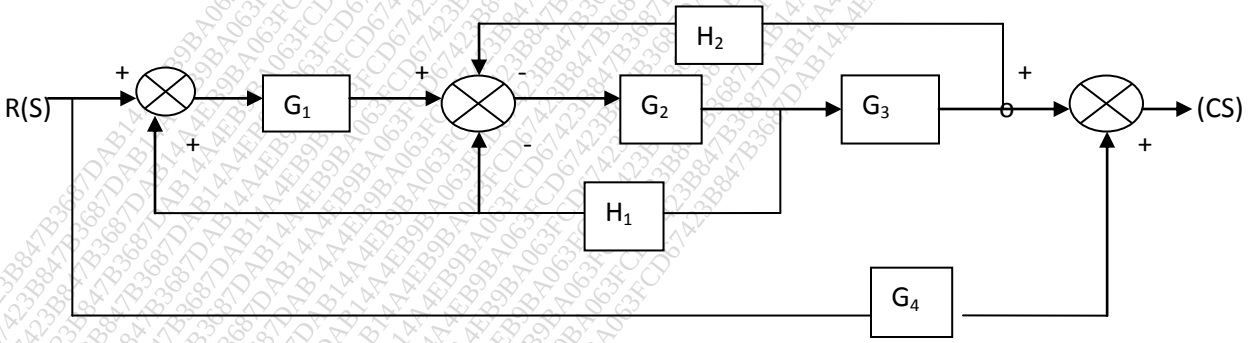

Fig. 1

2017

b)Determine the overall gain C(S)/R(S) for the signal flow graph as shown in fig.2 07

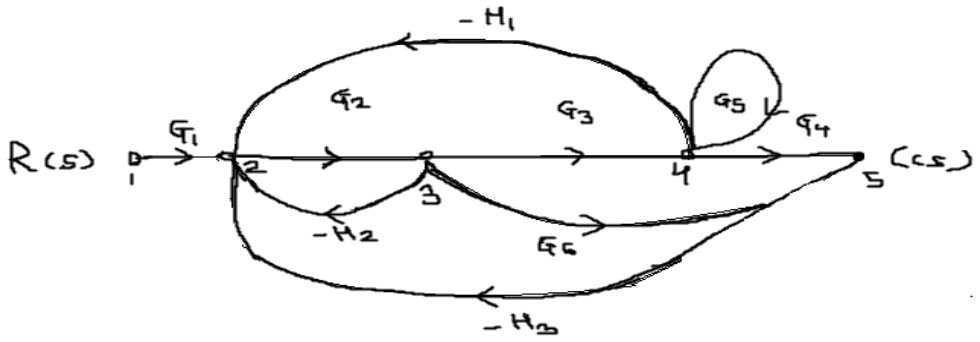

Fig. 2

Q.3 a) Derive the expression and draw the response of the first order system for unit step input. 08

b)The open loop transfer function of a servo system with a unity feedback is given by- 07

$G(S) = \frac{10}{(S+3)(S+6)}$

Determine the damping ratio, undamped natural frequency of oscillation. What is percentage overshoot of the response to a unit step input.

Q.4 a) Explain the DC servomotor working. 07

b)Find the static error coefficients for a system whose 08

$G(S)\,H(S) = \frac{10}{S(1+S)(1+2S)}$

Also find the steady state error for $r(t)= 1+t+t^2/2$

Q.5 a)A feedback system by the following transfer function. 08

$G(S)=\frac{12}{S^2+4S+16}$, $H(S) = Ks$

The damping factor of the system is 0.8. Determine the overshoot of the system & the value of K.

b)The characteristics equation of feedback control system is 07

$S^4+20S^3+15S^2+2S+K = 0$

Determine the range of K. For marginally stable find the frequency of sustained oscillation.

Section B

Q.6 Solve any five. 10

a) What is called a PID controller.
b) Define gain margin.
c) What are compensators?
d) List advantages of Bode plot.
e) What is meant by frequency response of system?
f) Define BIBO stability.
g) What is centroid? How the centroid is calculated.
h) Define absolute and relative stability?

Q.7 A unity feedback control system has an open loop transfer function. 15

$G(S) = \frac{K}{S(S^2+4S+13)}$

2017

Sketch the root locus.

Q.8 Sketch the bode plot and hence find gain crossover frequency, phase crossover frequency , gain margin & phase margin 15

$G(S) = \frac{10}{S(1+0.4S)(1+0.1S)}$

Q.9 a)The state space of a system is represented by the following equations. 08

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -3 & 1 \\ -2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad u \ ; \ t>0$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Find the transfer function of the system.

b)Find state transition matrix of following system. 07

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad u(t)$$

Q.10 a) Check the observability of the system. 08

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -4 & -3 \end{bmatrix} x + \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ -1 & 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 0 & 1 & -1 \\ 1 & 2 & 1 \end{bmatrix} x$$

b) Explain Rules for root locus plotting. 07