5E3125-R

Roll No. : _____ Total Printed Pages : 7

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B. Tech. (Sem. V) (Main/Back) Examination, December - 2011
Electrical & Electronics
5EX3 Control Systems (Common with Electricals Engg. 5EE3)

Time : **3** Hours] [Maximum Marks : **80**
[Min. Passing Marks : **24**

Instructions to Candidates :

*Attempt any **five questions** selecting **one question** from each **unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) What is control system ? Explain the basic architecture of closed loop control system by drawing the suitable block diagram. 2+6=8

(b) Explain and verify the following statements :

(i) A blind person walking on the road is closed loop control system. 4

(ii) All the manually operated instruments are the example of closed loop system. 4

OR

1 (a) Explain the multivariable control system with the suitable diagram.

8

(b) Explain and verify the following statements :

(i) The control of traffic by glowing the LED's (red, yellow and green) is the example of open loop system whereas control of traffic by the policeman is the example of closed loop control system.

4

(ii) Washing of clothes by washing machine is the example of open loop control system whereas washing of clothes manually is the example of closed loop control system.

4

UNIT - II

2 (a) A mechanical system is shown in the fig. 2(a) determine the following :

(i) Draw the equivalent circuit diagram.

3

(ii) Write down the nodal equations in time domain and in-s-domain.

3

(iii) Draw its force voltage and force-current equivalent analogous system.

3

(iv) For force voltage analogous system write down the equations representing the force-voltage analogous system.

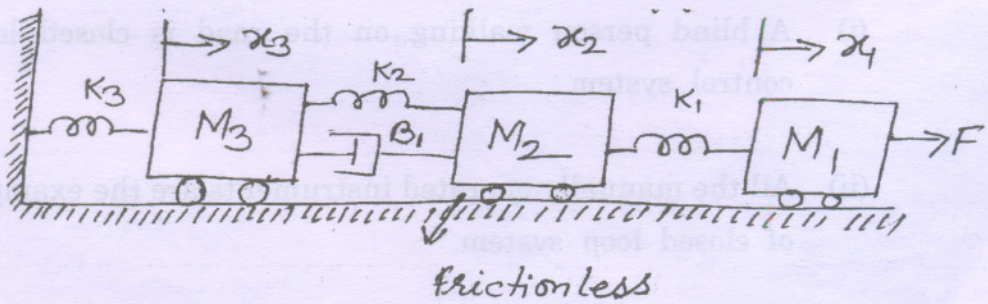

Fig. 2 (a)

3

(b) Determine the CLTF for the system shown in Fig 2(b) (Use block diagram reduction)

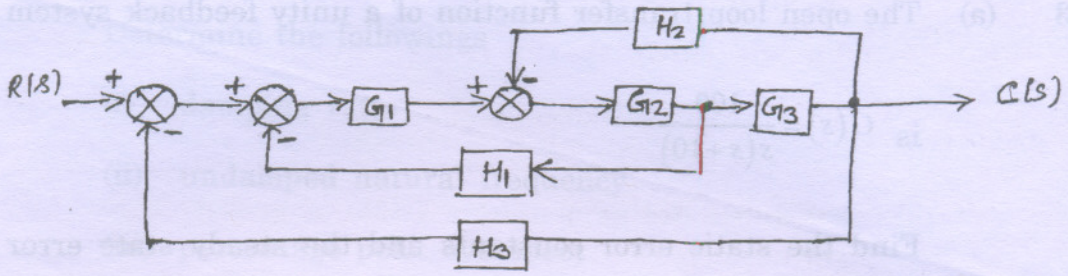

Fig. 2 (b)

4

OR

2 (a) Determine the CLTF of the system shown in Fig 2(a') (Only use the block diagram reduction)

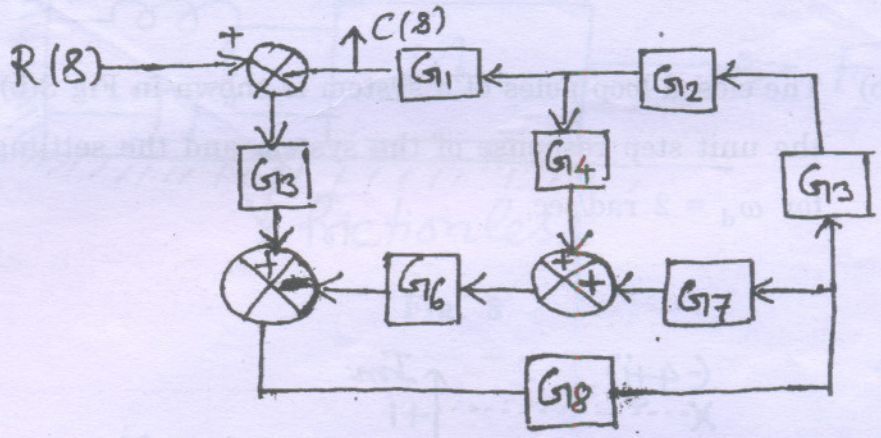

Fig. 2 (a')

8

(b) Find the $C_2(S)/R_1(S)$ of given system (Fig. 2b') using Mason's Gain formula.

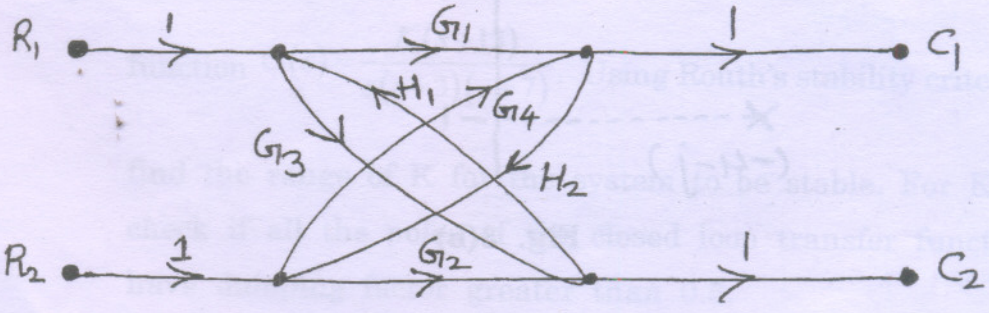

Fig. 2 (b')

8

UNIT - III

3 (a) The open loop transfer function of a unity feedback system is $G(s)=\frac{100}{s(s+10)}$

Find the static error constants and the steady state error of the system when subjected to an input given by the polynomial.

$r(t)=p_o+p_1t+(p_2/2)t^2$

8

(b) The closed loop poles of a system is shown in Fig 3(b). Find the unit step response of the system and the settling time for ω_d = 2 rad/sec.

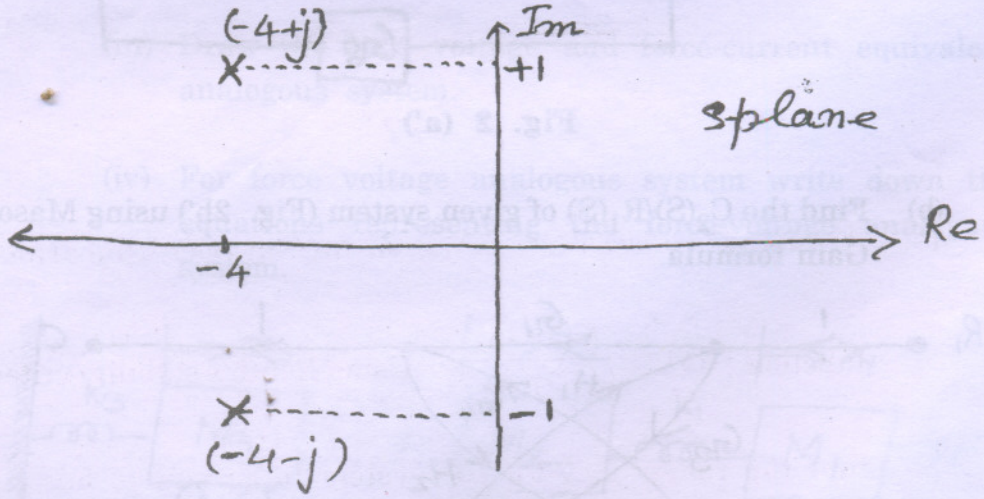

Fig. 3(b)

8

OR

3 A mechanical system is shown in Fig. 3. Assume that M=1, f=4 and K=5.

Determine the followings

(i) damping ratio

(ii) undamped natural frequency

(iii) percentage peak overshoot

(iv) Expression for the error response for unit step input.

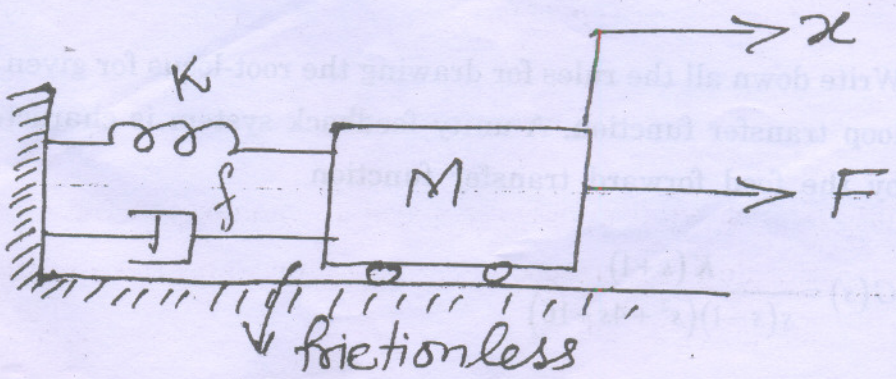

Fig. 3

4×4=16

UNIT - IV

4 (a) A unity feedback control system has an open-loop transfer function $G(s)=\frac{K(s+13)}{s(s+3)(s+7)}$. Using Routh's stability criteria, find the range of K for the system to be stable. For K=1, check if all the poles of the closed loop transfer function have damping factor greater than 0.5.

4

(b) Draw the Nyquist plot of given open Loop transfer function

$$G(s)H(s)=\frac{(4s+2)}{s^2(s+1)(2s+1)}$$

(i) determine the stability of the system

(ii) determine the gain margin (GM) of system

(iii) determine the phase margin of system

4×3=12

OR

4 Write down all the rules for drawing the root-locus for given open-loop transfer function. A unity feedback system is characterized by the feed forward transfer function

$$G(s)=\frac{K(s+1)}{s(s-1)(s^2+4s+16)}$$

Draw the Root-Locus and also find the range of K for the stability of the system.

16

UNIT - V

5 A standard second order system is shown in Fig. 5 in which Z is the damping ratio and ω_n is the natural undamped frequency in rad/sec.

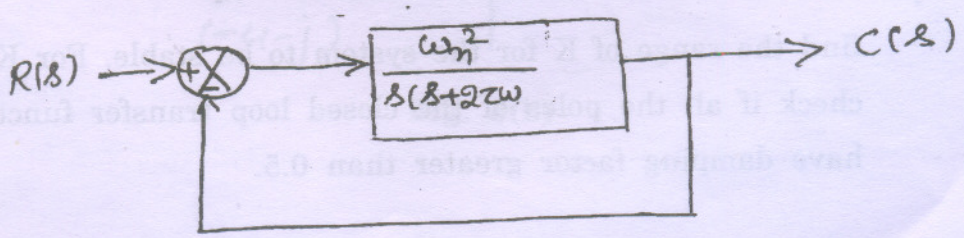

Fig. 5

If a PD-controller is connected ahead of the feedforward block of shown second order system, then prove that the PD-controller increases the damping ratio and maximum peak overshoot. Assume that the derivative time of PD-controller is T_d and take proportional gain kp=1.

16

OR

5 Compare lag, lead and lead-lag compensating Network in detail.

16
