5E3125

Roll No. : _____ Total Printed Pages : 4

# 5E3125

## B. Tech. (Sem. V) (Main/Back) Examination, December - 2013

**Electrical & Electronics**

**5EX3 Control Systems** (Common with EE and EX)

Time : 3 Hours] [Total Marks : 80

[Min. Passing Marks : 24

*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 What is control system ? Explain the basic architecture of open loop and closed loop control system. Also gives merits and demerits of both system. **16**

**OR**

1 Explain the term multivariability in control system. What is its significance in system ? **8**

2 Verify the following statements :

(a) An automatic coffee maker is an example of open loop control system.

(b) Controlling of traffic by policeman is an example of closed loop control system. **4×2=8**

## UNIT - II

1 Derive the value of transfer function for an translational mechanical system. Also explain and generate expression for force current and force voltage analogy for this system. **8**

2 Find the C/R of given system (Fig 2-a) using Mason's gain formula.

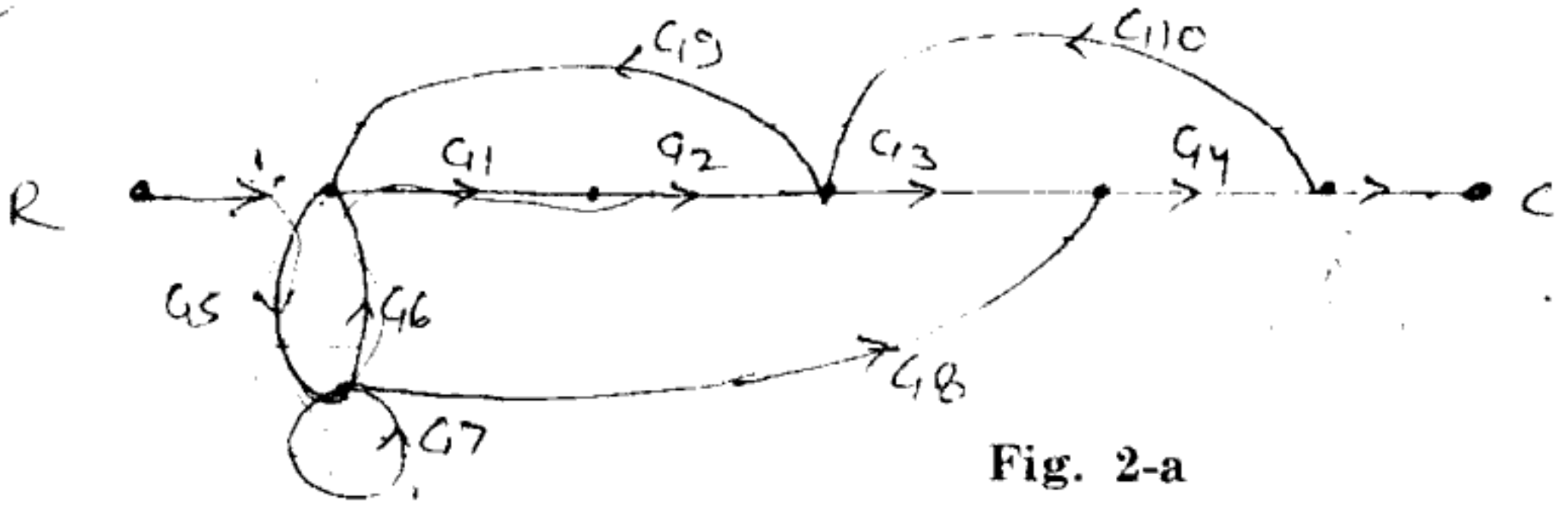


Fig. 2-a

8

**OR**

1 A armature controlled dc motor is supplied in with a from a 24 dc supply. The motor takes a current of 5 A on stalling and stalling torque being 0.915 nm. The motor runs at 1000 rpm taking current of 1 A. The moment of inertia and coefficient of viscous friction are 4 $\times 10^{-3}$ kg/m$^2$ and 1.5 $\times 10^{-3}$ NM/rad/sec. respectively. Determine transfer function of motor.

8

2 Determine C/D ratio for system shown in (Fig. 2-b)

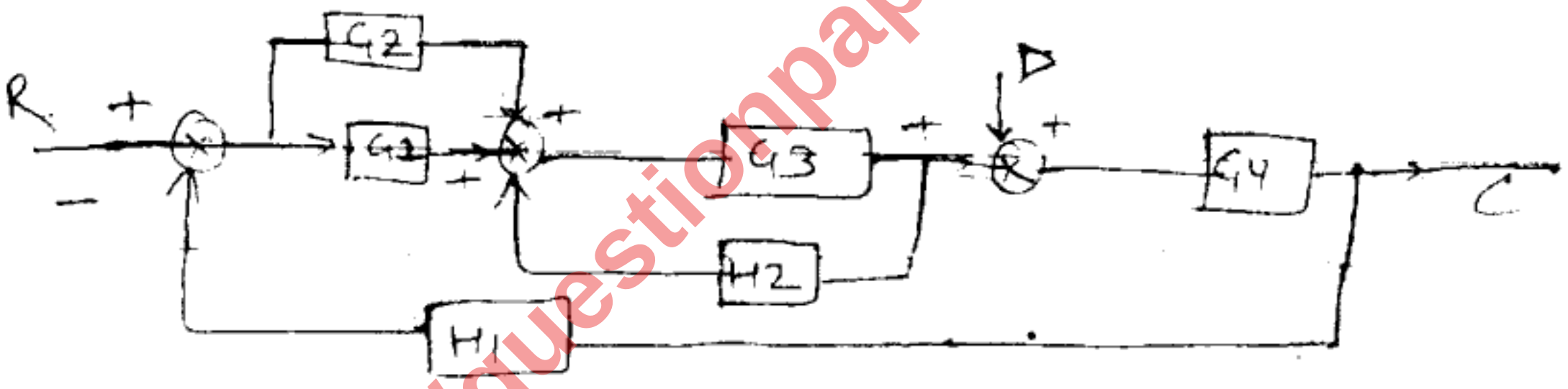


Fig. 2-b

8

## UNIT - III

1 Write a short note on steady state errors, also derive the relation between various types of transfer function and steady state errors with ramp input. Find the steady state error of system

$G(S) = \frac{100}{S(S+10)}$ for unit ramp input.

16

**OR**

1 For open loop transfer function of a unity feedback control system is given below. Determine value of K and β such that the closed loop unit step response has $\omega_n$ = 3 rad/sec and $\xi$ = 0.2.

$$G(S) = \frac{K(S+2)}{(1+\beta)S^2 + 4S + 1}$$

8

2 The overall transfer function of a control system is given by

$$\frac{C(S)}{R(S)} = \frac{16}{S^2 + 1.6S + 16}$$

It is desired that the damping ratio be 0.8. Determine the value of rise time, peak time, maximum overshoot and steady state error for unit step input without any feedback.

8

## UNIT - IV

1 A unity feedback system is characterized by the feed forward function

$$G(S) = \frac{50}{(S+1)(S+2)}$$

Draw the bodeplot for this and also find gain margin and phase margin of system.

12

2 Write down the procedure steps for plotting root locus.

4

**OR**

1 Draw the nyquist plot of given open loop transfer function $G(S)H(S) = \frac{15(1+4S)}{(S^2+100)(1+0.25S)}$. Determine its stability, gain margin and phase margin.

8

2 Investigate the stability of a unity feedback control system whose open loop transfer function is given by $G(S)=\frac{e^{-sT}}{S(S+2)}$ by using Routh-Hurtwitz criterion. 8

## UNIT - V

1 Write short notes on :
(a) Derivative Controllers
(b) Proportional Controllers. 8×2=16

**OR**

1 Why compensation is required in control system and explain the phase lead compensation. 8

2 The open loop transfer function of quality feedback control system is given by $G(S)=\frac{K}{S(1+0.2S)}$. Design a suitable compensator such that the system will have $K_v$ = 10 and P.M. = 50. 8