

### Section-C

**Note:** Attempt any two questions of the following.

(15×2=30)

10. For a unity feedback system, the open loop transfer function is

$$G(s)H(s) = \frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$$

Draw Bode Plot and determine gain margin, phase margin,

$\omega_{gc}$  and  $\omega_{pc}$ .

11. A system characterised by the transfer function

$$\frac{Y(s)}{u(s)} = \frac{2}{s^3 + 6s^2 + 11s + 6}$$
 Find the state and output

equation in matrix form and also test the controllability and observability of the given system.

12. Write short notes of the following:

- Lead compensator
- Lag compensator
- Gain Margin and Phase Margin

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(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 121522/121503 Roll No. 

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B.Tech.

(SEM. V) THEORY EXAMINATION, 2015-16

CONTROL SYSTEM

Time : 3 hours]

[Maximum Marks : 100

Section-A

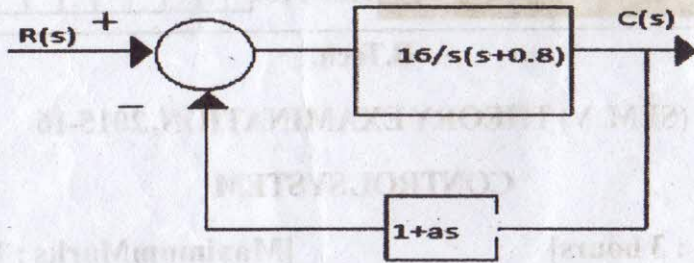
**Note :** Attempt all sections. All sections carry equal marks.

Write answer of each part in short. (2×10=20)

- Explain open loop and closed system with physical examples.
- State the necessary & sufficient condition of Routh Hurwitz criterion.
- Explain the significances of constant M & N circles.
- What is the need of compensation in control system?
- Draw the polar plot of open loop transfer function

$$\frac{1}{s^2}$$

- (f) What are state and state variables?
- (g) Consider the system as shown in Fig Determine the value of 'a' such that the damping ratio is 0.5.



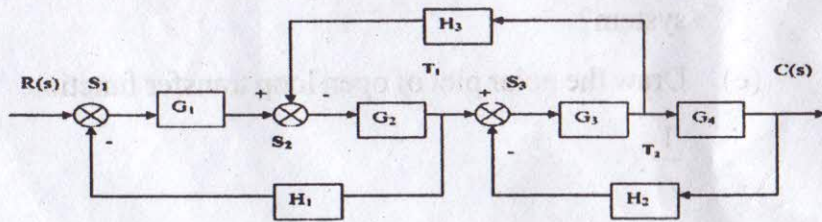
- (h) Define Rise time & Delay time for second order control system.
- (i) Explain Mason's gain formula.
- (j) Define the term Centroid & Break Away point.

### Section-B

**Note:** Attempt any five questions of the following.

(10×5=50)

2. Determine the transfer function  $C(s)/R(s)$  for the block diagram shown in Fig. below



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3. Derive the expression for step response of second order control system for under-damped.
4. Using Routh's stability criterion, determine the range of K open loop transfer function

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

5. Construct Root loci for open loop transfer function:

$$G(S)H(S) = \frac{K}{S(S+1)(S+3)}$$

6. Derive expression for resonant frequency and resonant peak for second order control system.
7. Sketch the Nyquist plot for the system with open loop transfer function

$$G(s)H(s) = \frac{60}{(s+1)(s+2)(s+5)}$$
 and comment on stability.

8. Write short notes on PD controller and Synchros.
9. Obtain state equation of a given transfer function"

a)  $\frac{Y(s)}{U(s)} = \frac{1}{s^3 + 2s^2 + 3s + 1}$

b)  $\frac{Y(s)}{U(s)} = \frac{1}{(s+1)(s+4)}$

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P.T.O