



Printed Pages : 4

TEE502

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

PAPER ID : 2056

Roll No.

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**B.Tech**

**(SEM V) ODD SEMESTER THEORY EXAMINATION 2009-10**  
**CONTROL SYSTEM**

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions.

1 Attempt any four parts : 4×5=20

- (a) Explain open loop and closed loop controls with the help of suitable examples.
- (b) Discuss the effect of feedback on the following :
  - (i) Sensitivity
  - (ii) Stability
  - (iii) Error.
- (c) Find the transfer function of the system shown in the **fig.1** using Mason's gain formula

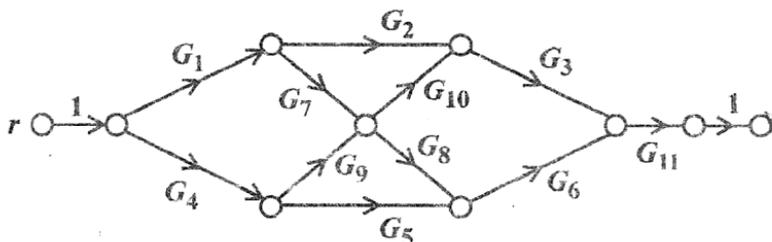


Fig. 1

- (d) Explain block diagram reduction technique to determine transfer function of a complicated system.



- (e) For the system represented by the following equations, find the transfer function  $X(s)/U(s)$  by signal flow graph technique :

$$X = X_1 + \beta_3 U$$

$$X_1' = -a_1 X_1 + X_2 \beta_2 U$$

$$X_2' = -a_2 X_2 + \beta_1 U$$

- 2 Attempt any four parts : 4×5=20

- (a) For the system shown in the fig. 2 (i) determine  $\xi$  and  $\omega_n$  without  $K_D$  (ii)  $K_D$  for  $\xi = 0.60$  with controller.

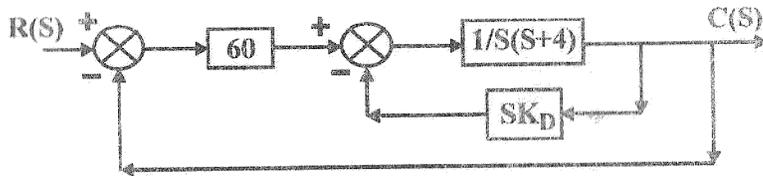


Fig. 2

- (b) Derive the formula for Peak overshoot, Rise time and Peak time.  
 (c) Discuss the PI and PID controllers with their applications and their error constant.  
 (d) A unity feedback system is characterized by the open loop transfer function

$$G(S) = \frac{1}{S(0.5S+1)(0.2S+1)}$$

Determine the steady state errors for unit step and unit ramp input. Also determine the damping ratio and natural frequency of the dominant roots.

- (e) For a general second order systems find the  $c(t)$ , when input is unit step.

- 3 Attempt any two parts : 2×10=20

- (a) (i) Determine the values of  $K > 0$  and  $a > 0$ , so that system having :

$$G(S) = \frac{K(S+1)}{S^3 + aS^2 + 2S + 1}$$

$H(S) = 1$  oscillates at a frequency 2 rad/s.

- (ii) Find the stability of the following polynomial by Hurwitz criterion

$$F(S) = S^5 + 2S^4 + 3S^3 + 6S^2 + 2S + 1$$

- (b) Discuss the constructional feature and working principle of AC servomotor.  
 (c) Draw the root locus plot of :

$$1 + \frac{K(S+1)(5)}{S(S+1)(S+5)(S+15)}$$

and also comment on its stability.

- 4 Attempt any two parts : 2×10=20

- (a) Establish the correlation between time response and frequency response analysis and suitably explain with diagrams.  
 (b) Draw the bode plot of the given function

$$G(j\omega) = \frac{4(1+j\omega/2)}{j\omega \left( 1 + \frac{j\omega}{10} - \left( \frac{\omega}{10} \right)^2 \right)}$$

- (c) Sketch the Nyquist plot for the following transfer function

$$G(S)H(S) = \frac{K}{S^2(1+\tau S)}$$

For  $K > 0, \tau > 0$ .

5 Attempt any **two** parts :

**2×10=20**

- (a) Express the following open loop transfer function in closed loop form using unity feedback. Draw the signal flow graph :

$$\frac{C(S)}{R(S)} = \frac{3}{S^4 + 2S^3 + 3S + 2}$$

- (b) Design the lead compensator for a unity feedback control system with open loop transfer function

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

Such that velocity error constant  $K_v = 10$  and phase margin of the system be at least  $45^\circ$ .

- (c) Discuss the working of the Lag-Lead Compensator. Sketch the Bode Plot of Lag-Lead compensator. Give the design steps of a lag compensator.
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