

Con. 2831-09.

Control System  
(REVISED COURSE)

VR-3312

29/05/09

(3 Hours)

[ Total Marks : 100

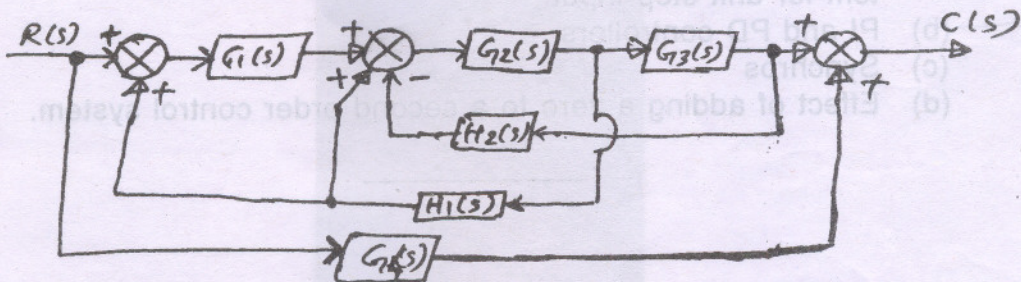
3 p.m. to 6 p.m.

- N.B.:** (1) Question No. 1 is **compulsory**.  
 (2) In total, solve **five** questions.  
 (3) Assume **suitable data**, wherever **required**.  
 (4) **Figures** to the **right** indicates the marks.

1. Attempt following questions :

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- Compare the open loop and closed loop control system with suitable example and block diagram.
  - What do you know about modelling in control system. Explain various types.
  - State and prove block diagram reduction rules.
  - Compare the time response analysis with frequency response analysis.
  - Define stability. Explain various types of stability.
2. (a) Find transfer function of the system shown by following block diagram 10  
 using block diagram reduction technique.



- Verify the answer of part(a) of this question using signal flow graph technique. 10
3. (a) Determine the output response of second order underdamped control system 10  
 when subjected to unit step input.
- A unity feedback control system has a loop transfer function,  $G(s) = \frac{10}{s(s+2)}$ . 10  
 Find the rise time, percentage overshoot, peak time and settling time for a step input of 12 units.
4. (a) Sketch the root locus for a given unity feedback control system whose open 10  
 loop transfer function is  $G(s) = \frac{K}{s(s^2 + 2s + 2)}$ .
- Explain all the rules with supporting example to each rule for the construction 10  
 of root locus.

5. (a) Sketch the Bode plot and determine GM and PM for the transfer function **15**

$$G(s) = \frac{75(1+0.2s)}{s(s^2 + 16s + 100)}$$

- (b) Test the stability of the system with the following characteristic equation by Routh's test. **5**

$$s^6 + 2s^5 + 8s^4 + 20s^2 + 16s + 16 = 0$$

Also find the value of sustained oscillation frequency.

6. (a) Sketch the polar for the system having transfer function  $G(s) = \frac{1}{s(1+s)^2}$ . **8**

- (b) Draw the Nyquist plot for a given open loop transfer function and test the stability. Find GM and phase crossover frequency. **12**

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

7. Write short notes on following :—

- (a) Time Response specifications of 2nd order underdamped control system for unit step input.
- (b) PI and PD controllers
- (c) Synchros
- (d) Effect of adding a zero to a second order control system. **20**