

BT-6/J04

Control System

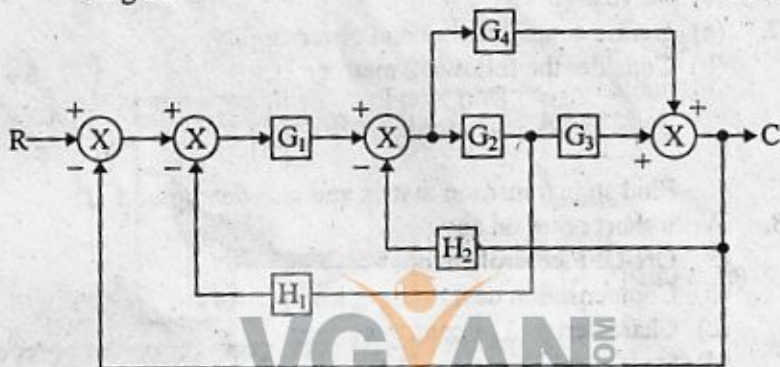
Paper : EE-304

Time : Three Hours]

[Maximum Marks : 100

Note : Attempt any five questions.

1. (a) Classify different types of control system. Give suitable example.
- (b) Find the signal flow graph and determine C/R for the block diagram. 8+12



2. (a) Define different steady state error constants. What are their significance ?
- (b) Consider the system shown below. Determine the value of k such that the damping ratio δ is 0.5. Hence obtain the resonance, peak time, max overshoot and settling time. 8+12
3. (a) Define stability and relative stability.
- (b) A unity feedback control system is characterised by open loop transfer function

$$G(s) = \frac{k(s+13)}{s(s+3)(s+7)}$$

Using Routh criterion, calculate the range of k for the system to be stable. Check if $k=1$, all these roots of the characteristics equation of the above system have damping factor greater than 0.5. 8+12

4. The open loop transfer function of a closed loop system is

$$G(s)H(s) = \frac{k}{s(s+6)(s^2+4s+13)}$$

Sketch the root locus and determine break away point, angle of departure from complex poles and stability condition. 20

5. Consider following transfer function

$$G(s)H(s) = \frac{60}{(s+1)(s+2)(s+5)}$$

Using Nyquist stability criterion determine whether the closed loop system is stable or not. 20

6. Write notes on :

- (a) Error detectors
- (b) dc servo motor
- (c) Servo amplifier

7. (a) Define controllability and observability.

- (b) Consider the following matrix :

8+12

$$A = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix}, x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

Find state transition matrix and also determine $x(t)$.

8. Write short notes on any :

20

- (a) ON-OFF control action
- (b) Compensation design using lead network
- (c) Characteristics of control system
- (d) System specifications in time and frequency domain