Time: 3 Hours **Marks: 80**

Note:

1) Question No. **1** is **compulsory**.
2) Attempt any **three** questions from remaining **five** questions.
3) Make suitable **assumption** wherever **necessary** and mention the same.
4) Use graph paper and semilog paper wherever necessary.
5) **Figures** to the **right** indicate **full** marks.

Q.1) Attempt **any four**:

A) Explain the difference between open loop and closed loop system. **05 Marks**

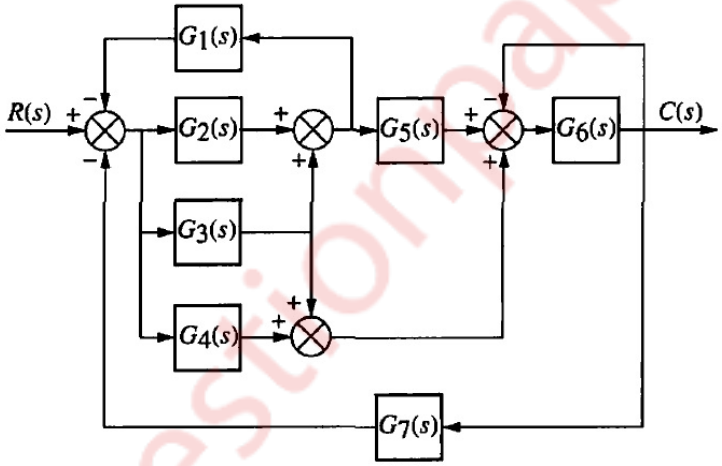
B) State an advantages of using state space analysis over classical control approaches. **05 Marks**

C) Write a short note on transient response specifications. **05 Marks**

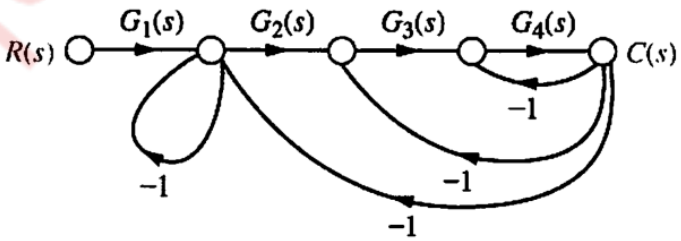
D) Explain the effect of addition of open loop poles and zeros on root locus. **05 Marks**

E) Explain stability in polar plot. **05 Marks**

Q.2) A) Find overall transfer function C(s)/R(s) of the given system using block diagram reduction method. **10 Marks**



B) Find overall transfer function C(s)/R(s) for the given signal-flow graph using mason's gain formula. **10 Marks**



Q.3) A) For a unity negative feedback system having **G(s) = 225 / (s*(s+12))** determine all-time domain specifications for unit step input. **10 Marks**

B) Sketch the complete root locus for the system given below. Also find the range of gain K within which the system is stable. **G(s)H(s) = K / (s*(s+2)*(s+4)*(s+8))**. **10 Marks**

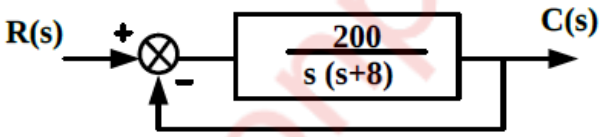
Q.4) A) For the system having **C(s)/R(s) = (s+5) / (s^3+9*s^2+24*s+26)**. Obtain the phase variable form of state space model. Also draw the state model. **10 Marks**

B) Find the stable operating range of gain and the value of K_{marg} by using Routh – Hurwitz criterion for the unity negative feedback system having **G(s) = K / (s*(s+9)*(s+15))**. **10 Marks**

Q.5) A) Draw the bode plot and determine gain margin and phase margin for the system having **G(s)H(s) = 10000 / ((s+5)*(s+20)*(s+50))** **10 Marks**

B) Draw the nyquist plot and comment on stability for the system having **G(s)H(s) = 20 / (s*(s+4)*(s-2))** **10 Marks**

Q.6) A) Determine the steady state error for system given below, where R(s) is the ramp input of magnitude 2. If it is desired to reduce existing error by 5% find new value of gain of the system. **07 Marks**



B) Explain how to calculate static error constants from Bode magnitude plot. **07 Marks**

C) Write a short note on AC servomotor. **06 Marks**

****