T.E. (Electrical) Sem-VI (CBSGS) 1/3 ##
Control System-I 30/5/18

Q.P. CODE: 38392

Time: 3 Hours **Marks: 80**

Note:

- Question No. 1 is compulsory.
- Answer any **three** from the remaining five questions.
- Assume suitable data if necessary and justify the same.

Q. 1 Answer any FOUR of the following 20

a. What is the significance of asymptotes in root locus plot?

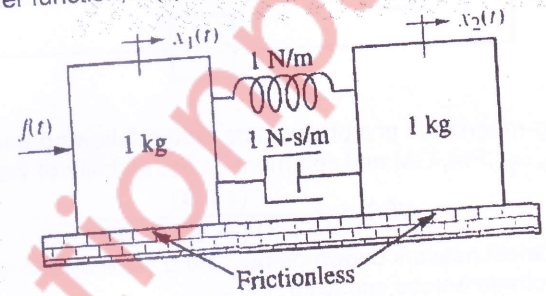
b. Explain the difference between open loop and closed loop control system.

c. Find how many poles are in the LHS, RHS and on the imaginary axis of s-plane of the given system.

$$\dot{x} = \begin{bmatrix} 0 & 3 & 1 \\ 2 & 8 & 1 \\ -10 & -5 & -2 \end{bmatrix} x + \begin{bmatrix} 10 \\ 0 \\ 0 \end{bmatrix} u$$

d. Explain gain crossover frequency, phase crossover frequency, gain margin and phase margin in frequency response technique.

e. Find the transfer function, $G(s) = X_2(s) / F(s)$ for circuit shown below



Q.2 a. Obtain the cascade, parallel and phase variable form representation of state space and signal flow graph for the system having. 10

$$G(s) = \frac{24}{(s+1)(s+2)(s+3)}$$

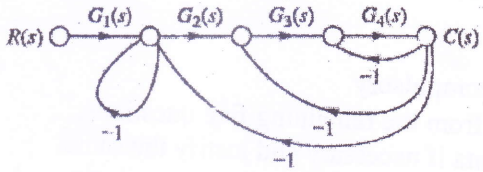
b. For the following unity feedback system, using Routh Hurwitz criteria determine the range of K to ensure stability. What should the value of K for the system response to oscillate, and determine the frequency of oscillations. 10

$$G(s) = \frac{K(s+3)}{s(s+1)(s+2)(s+4)}$$

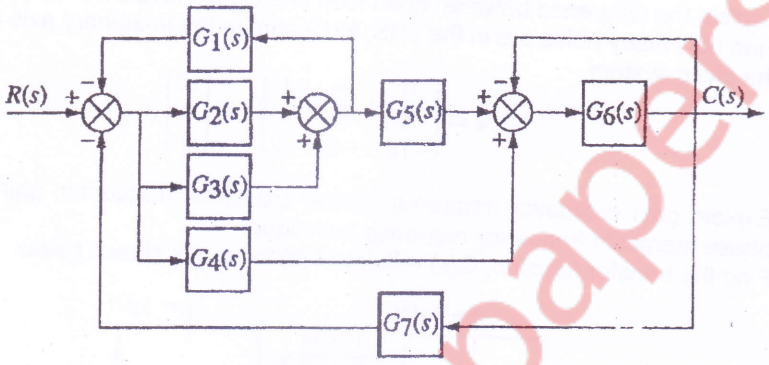
T.E. (Electrical) Sem - VI (CBSGS) 2/3
Control System-I 30/5/18

Q.P. CODE: 38392

Q.3 a. Obtain transfer function of the given system using Mason's gain formula. 10



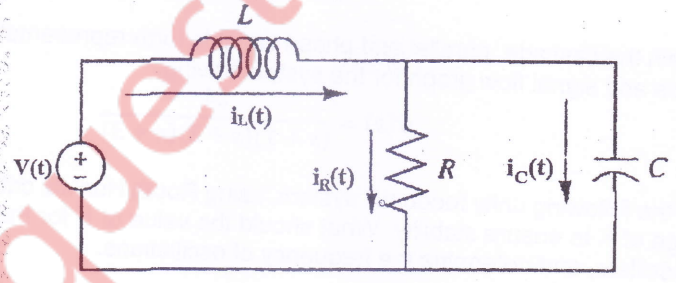
b. Reduce the block diagram shown below to a single block representing the transfer function, G(s) = C(s)/R(s) 10



Q.4 a. Draw Bode log-magnitude and phase plots for the following unity feedback system, determine ω_{gc}, ω_{pc}, PM, GM and comment on the stability of the system. 10

$$G(s) = \frac{(s+3)}{(s+2)(s^2+2s+25)}$$

b. Given the electrical network shown below, find a state-space representation if the output is the voltage across capacitor. 10



Q.5 a. Derive and explain Nyquist stability criteria. 10

b. Derive the formula for rise time, peak time, settling time and percentage overshoot in step response of second order underdamped system. 10

T.E. (Electrical) Sem - VI (CBSGS)
Control System-I 30/5/18

6 a. A unity feedback system has an open-loop transfer function 10

$$G(s) = \frac{K}{(s+3)(s^2+4s+5)}$$

Draw root locus and find the location of the closed loop dominant poles if the system is operating with 15% overshoot. Also determine value of K at the above-mentioned overshoot.

b. Define and derive the steady state error and error constants with respect to unit step, unit ramp and unit parabolic inputs. Consider unity feedback system. 10
