Q. Code: 780941

B.E./B.TECH. Degree Examination, December 2020

Fourth Semester

EC16405 – CONTROL SYSTEM ENGINEERING

(Regulation 2016)

Time: Three hours Maximum: 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

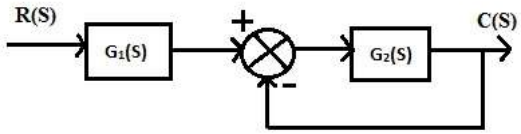
1. If the output response of the system is oscillating then the oscillation is due to
   a. Positive Feedback
   b. Negative Feedback
   c. No Feedback
   d. None of these

2. The transfer function of a system is given by $\frac{C(s)}{R(s)} = \frac{9}{S^2+2S+9}$. The nature of the response will be
   a. Overdamped
   b. Underdamped
   c. Critically damped
   d. Undamped

3. The poles of the given transfer function are T(s)=$\frac{K(s+2)}{s(s^2+4s+13)}$
   a. 2, 0, -2
   b. 0, -2+j3, -2-j3
   c. 0, 2+j3, 2-j3
   d. -2, 2+j3,2-j3

4. Root locus is used to calculate:
   a. Marginal Stability
   b. Conditional Stability
   c. Relative Stability
   d. Absolute Stability

5. Find the transfer function of the network given in below figure.



6. Determine rise time and peak time for the given transfer function

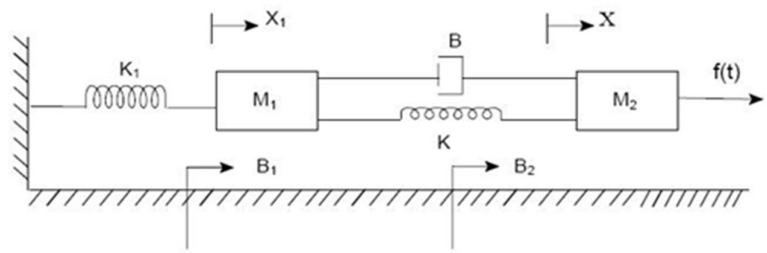
   T(s) = $\frac{16}{S^2+2S+16}$

7. Draw electrical lag-lead compensator network?

8. The characteristics equation of a closed loop transfer function is given by $S^3 + 5S^2 + 7S + 3 = 0$. Determine the stability of the system.

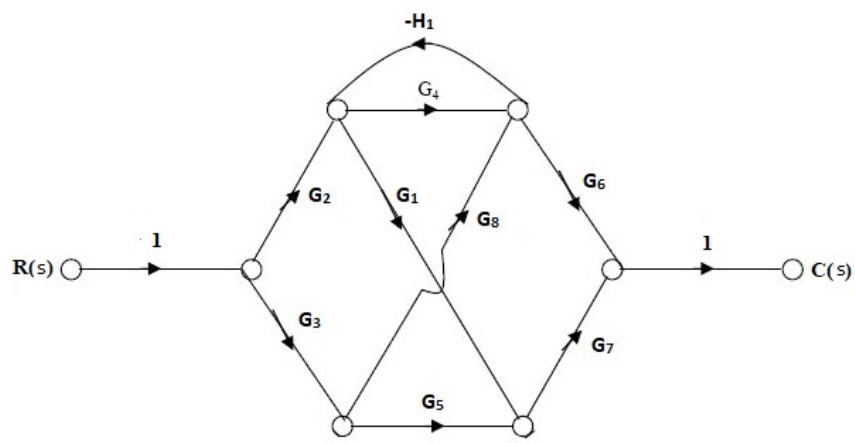
PART B - (4 X16 = 64 marks)

9. (a) Write the Differential equations governing the mechanical translational system shown in fig. and find the transfer function. **(16)**



(OR)

(b) Obtain the overall gain C(s) / R(s) for the signal flow graph shown in fig. **(16)**



10. (a) The unity feedback system is characterized by an open loop transfer function is G(s)= $\frac{K}{S(S+4)}$ .Determine the gain K, so that the system will have a damping ratio of 0.5. For this value of K, determine Rise time, Peak time, Maximum Peak overshoot and Settling time for a unit-step input. **(16)**

(OR)

(b) For a unity feedback control system, the open loop transfer function G(s) = $\frac{2(S+6)}{S^2(S+1)}$. Find (a) position, velocity and acceleration error constants. **(16)**

(b) The steady state error when the input is R(s) where R(s) = $\frac{3}{S} - \frac{2}{S^2} - \frac{1}{3S^3}$.

11. (a) A unity feedback control system has G(s) $=\frac{5(s+2)}{S(S+10)}$. Draw the bode plot and also find the gain margin and phase margin of the system. **(16)**

(OR)

(b) A unity feedback control system has an open loop transfer function G(s)$=\frac{K(S+1)}{S^2(S+3.6)}$. Sketch the root locus. **(16)**

12. (a) (i) Determine the stability of unity feedback system whose open loop transfer function is G(s)$= \frac{1}{s(s+2)(s+4)(s^2+6s+25)}$. **(8)**

(ii) Determine the stability of the system whose characteristics equation is $s^4 + 2s^3 + 3s^2 + 4s + 5 = 0$. **(8)**

(OR)

(b) (i) Test the controllability and observability of the system by any one method whose state space representation is given as **(16)**

$$\begin{bmatrix} \dot{x_1} \\ \dot{x_2} \\ \dot{x_3} \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} u \; ; y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$