Seat No: _____ Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

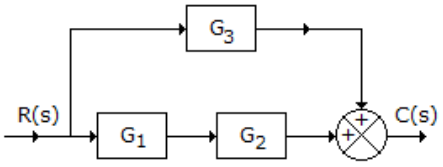
B.Tech. Summer 2018 - 19 Examination

Semester: 4 **Date: 06/05/2019**
Subject Code: 03107256 **Time: 02:00pm to 04:30pm**
Subject Name: Control Theory and System **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 **Objective Type Questions** - (Fill in the blanks, one word answer, MCQ-not more than Five in case of MCQ) (All are compulsory) (Each of one mark) **(15)**

1. A control system in which the control action doesn't depend on the output is known as
   (a) Closed loop system (b) Semi closed loop system
   (c) Open loop system (d) None of Above
2. A second order control system has the damping ratio (ξ) 0.48. The system is
   (a) Over Damped (b) Under Damped
   (c) Critically Damped (d) None of Above
3. A Voltage stabilizer is _____ loop control system.
   (a) Closed loop system (b) Semi closed loop system
   (c) Open loop system (d) None of Above
4. At summing point, more than one signal can be added or _____
   (a) Subtracted (b) Multiplied
   (c) Both a & b (d) None of Above
5. For the system in the below figure, the transfer function is _____ when $G_1 = G_2 = G_3 = 1$



   (a) 1 (b) 2
   (c) 3 (d) 4

6. In force-voltage analogy, Resistance is analogy to _____.
7. In a signal flow graph, nodes are represented by small _____.
8. If an impulse response of a system is $\mathbf{e^{-2t}}$, _____ would be its transfer Function?
9. List the error constants to calculate the steady state error when subjected to different inputs.
10. Write the close loop transfer function with gain of 12, poles at -4, +1 and zero at-5.

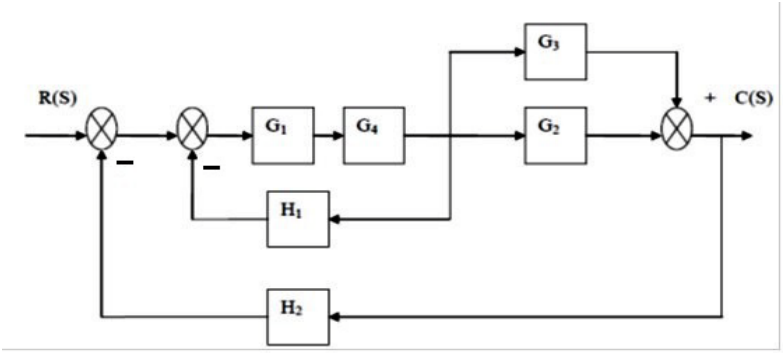
Define the following terms.
11. Open loop control system
12. Settling time
13. Stability of control system
14. Maximum Overshoot
15. Rise Time

Q.2 Answer the following questions. (Attempt any three) **(15)**

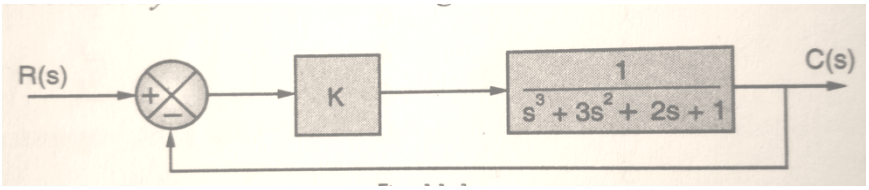
A) What is Control System? Explain Open loop and Close loop control system with suitable examples.

B) Determine the time response c(t) of first order control system subjected to unit ramp function.

C) The block diagram of a closed loop system is shown in the below figure. Using the block diagram reduction technique; determine the closed loop transfer function C(s)/R(s).



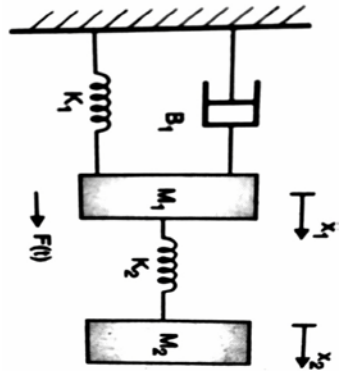
D) A control system is shown in below figure. Find the range of K for which the system is stable using Rauth-Hurwitz (R-H) criterion.



Q.3 A) Find the transfer function for the system given by state space model **(07)**

$A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$, $C = [1 \quad 0]$, $D = 0$

B) For the control system shown in below figure, Find system equation and draw mechanical node diagram .Draw analogous circuit using Force-Voltage (F-V) analogy. **(08)**



OR

B) The Transfer function of the control system is given by **(08)**

$$\boldsymbol{G(s) = \frac{18}{(s^2 + 4s + 18)}}$$

Determine the characteristic equation of the system, ω_n , ξ, ω_d , M_p, time for first undershoot.

Q.4 A) What is PD (Proportional +Derivative) Controller? Discuss the effect on the performance of a second order control system of PD Controller. **(07)**

OR

A) For the unity feedback control system, **(07)**

$$\boldsymbol{G(s) = \frac{10}{s\,(s+1)(s+5)}}$$

Sketch the Bode plot. Determine gain and phase margin. Comment on the stability of the system.

B) Sketch the root locus for open-loop transfer function of a unity feedback control system given by **(08)**

$$\boldsymbol{G(s) = \frac{K}{s\,(s+1)(s+3)}}$$

Find the value of K for marginal stability.