PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer 2018 - 19 Examinations

Semester: 03/04   Date: 06/05/2019
Subject Code: 03112201   Times: 2:00 pm to 4:30 pm
Subject Name: Control Theory   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 Do as directed**   **(15)**
1. Which of the following are the disadvantages of a closed loop control system?
   (a) Reduces the overall gain.
   (b) Complex and costly.
   (c) Oscillatory response.
   (d) All of the above.
2. By using which of the following elements, mechanical translational systems are obtained?
   (a) Mass element
   (b) Spring element
   (c) Dash-pot
   (d) All of the above
3. The type of a control system is obtained from -------------- transfer function?
   (a) Open loop
   (b) Closed loop
   (c) Both open loop and closed loop
   (d) None of above.
4. The open loop transfer function of a unity feedback system is given by G(s) = 1/(s+2)². The closed loop transfer function will have poles at
   (a) -2,-2
   (b) -2,-1
   (c) -2+j,-2-j
   (d) -2,2
5. The optimum values of damping ratio is --------------
   (a) 0.9 to 1.1
   (b) 0.3 to 5
   (c) 0.3 to 0.7
   (d) 0 to 2
6. Define : delay time
7. Define : Peak time
8. What is State variable?
9. Define : plant
10. What is steady state error?
11. Define : gain cross over frequency
12. What is Transfer function?
13. A unity feedback system with $G(s) = \frac{4}{s(s+2)}$ has damping ratio _____.
14. Define : Rise time
15. Define pole and zero of transfer function.

Q.2 Answer the following questions. (Attempt any three)   **(15)**
   A) Explain open loop and closed loop control system.
   B) Derive the transfer function of close loop control system.
   C) Explain standard test signals.
   D) Briefly explain Signal flow graphs with their properties. Also explain Mason's gain equation for signal flow graph.

Q.3 A) Determine close loop transfer function of the system shown below using block diagram   **(07)**
     reduction techniques.
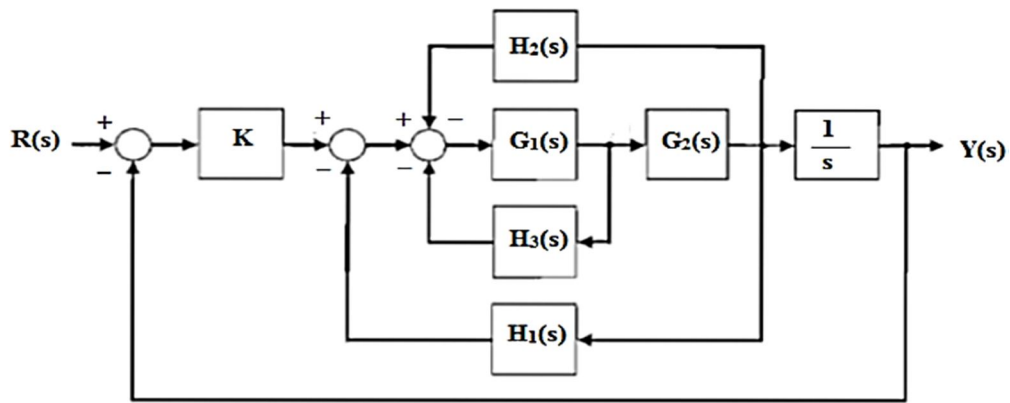
B) Derive the unit step response of second order unity feedback control system for under damped system. **(08)**

$$\frac{C(s)}{R(s)} = \frac{\omega_n^2}{S^2 + 2\xi\omega_n S + \omega_n^2}$$

OR

B) For the system with the transfer function **(08)**

$$\frac{C(s)}{R(s)} = \frac{16}{S^2 + 1.6S + 16}$$

Find (1) rise time (2) damped frequency (3) peak time (4) max. peak overshoot (5) settling time

Q.4 A) Determine the stability to $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$ **(07)**

OR

A) Explain force-voltage analogy and force-current analogy with suitable example. **(07)**

B) List out the rules of root locus. **(08)**