GANPAT UNIVERSITY

B. Tech. Semester: VI Mechanical Engineering
CBCS Regular Examination April – June 2016
2ME601 Control System Engineering

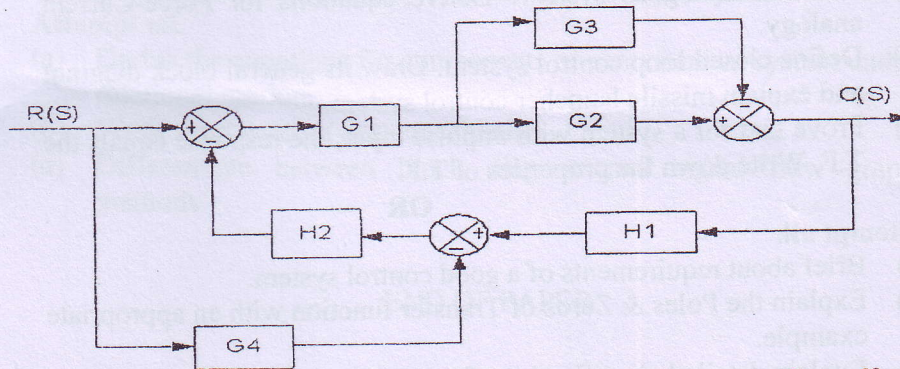Time: 3 Hours   Total Marks: 70

Instruction: 1. All questions are **compulsory**.
               2. Figures to the **right** indicate full marks.
               3. Answers to the two sections must be written in **separate** answer books.
               4. Assume all necessary data.

Section - I

Que. – 1   **Attempt all.**   12
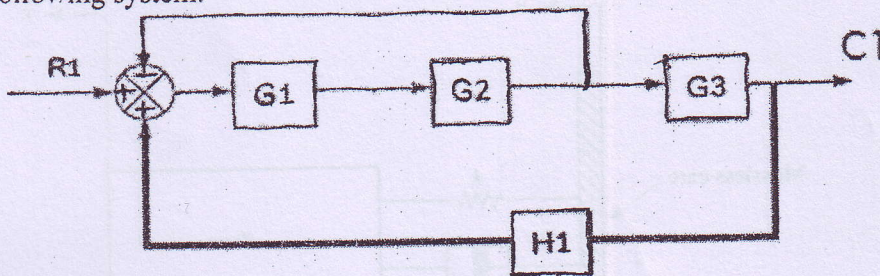 (a) Find open loop system transfer function using block diagram reduction techniques.

  (b) Using frequency domain analysis, explain how PD controller affects bandwidth of a control system.

OR

Que. – 1   **Attempt all.**   12
  (a) Explain effect of PI controller over steady state error and rise time.
  (b) Determine C1(s)/R1(s) using block diagram reduction technique for following system.

Que. – 2   **Attempt all.**   11
  (a) A feedback control system has an open loop transfer function   08

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

       Draw root locus plot.
  (b) What is the need for standard inputs in control system? Name standard   03
       inputs and represent them graphically.

OR

Que. – 2   Attempt all.   11

    (a) Derive formula to find rise time of second order system.   05

    (b) For second order system, determine the values of ζ and ω_n so that the   06
system responds to a step input with approximately 5% overshoot and with
a settling time of 2 sec.

Que. – 3   Attempt all.   12

    (a) Write transfer function of PID controller. Summarize steps to implement
PID controller.

    (b) Write a short note on Sugeno fuzzy logic controller.

    (c) Explain following membership functions:
        i.   Triangular membership function
        ii.   Trapezoidal membership function
        iii.   Sigmoidal membership function
        iv.   Gaussian membership function

Section – II

Que. – 4   Attempt all.   12

    (a) What is analogous system? Derive equations for Force-Current
analogy.

    (b) Define closed loop control system. Draw its general block diagram
and explain missile launcher control system.

    (c) Prove that for a system with impulse input, the response equals the
T.F. Write down the properties of T.F.

OR

**Que. – 4   Attempt all.**   12

    (a) Brief about requirements of a good control system.

    (b) Explain the Poles & Zeros of Transfer function with an appropriate
example.

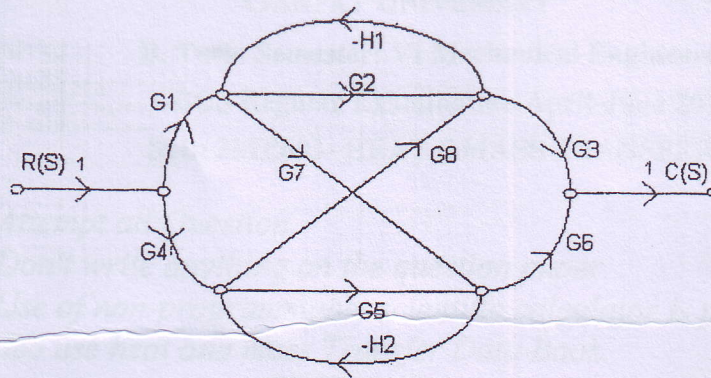   (c) Explain detailed classification of control systems.

Que. – 5   Attempt all.   11

    (a) Draw free body and nodal diagram for the system shown below. Find out   06
the transfer function and also derive Force-Voltage analogy for given
system. u= force, y= displacement.

Massless cart

(b) Using Mason's formula determines C(S)/R(S).   05
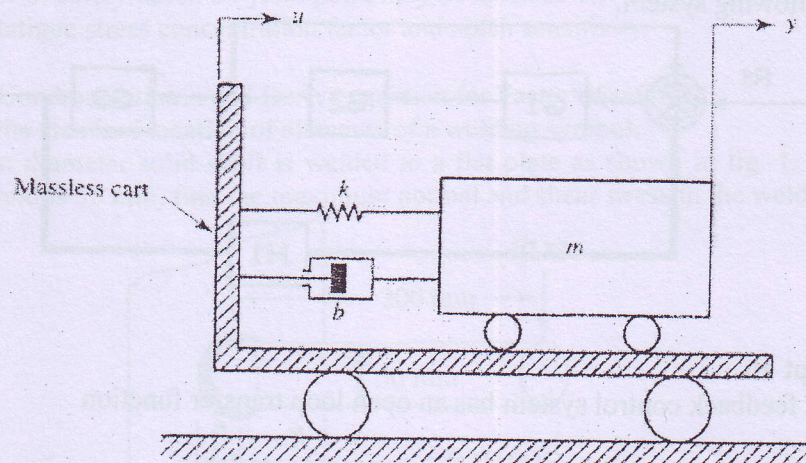
OR

Que. – 5   Attempt all.   11
(a) Describe working of pneumatic flapper valve and pneumatic relay   06
    with neat sketch.
(b) What is the difference between fuzzy controller and conventional   05
    controller? Describe fuzzy system with one input system.

Que. – 6   Attempt all.   12
(a) Derive the equations for components of a mechanical system under
    rotational motion.
(b) Write short note on Servomechanism.
(c) Differentiate between block diagram and signal flow graph
    methods.

END OF PAPER