

**KADI SARVA VISHWAVIDHYALAYA**  
**LDRP-ITR, GANDHINAGAR**  
**BE 4<sup>th</sup> SEMESTER (ELECTRICAL)**  
**Mid Semester Exam (Reg. / ATKT)– 2015**

**Subject Code: -EE402**

**Date: 03 /03/2015**

**Time: -12:00pm to 01:30pm**

**Subject Name: -CONTROL SYSTEMS**

**Total Marks:-30**

**Instructions:**

1. Use of Scientific Calculator is permitted.
  2. All questions are Compulsory.
  3. Indicate clearly, the options you attempt along with its respective question number.
  4. Use the last page of main supplementary for rough work.
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**Q-1 [A]** Explain a Control system with a block diagram & differentiate between open loop and close loop system. [05]

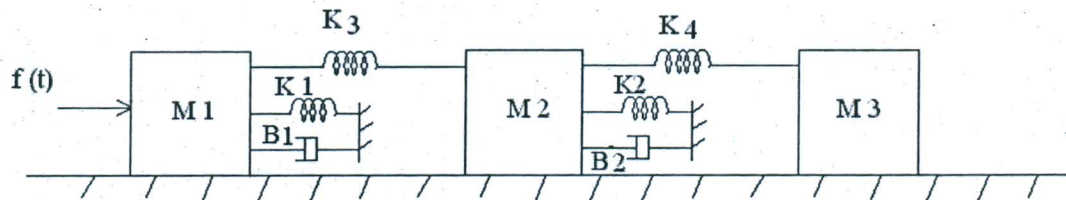
**[B]** Consider the following characteristic equation: [05]

$$s^4 + 2s^3 + (4+K)s^2 + 9s + 25 = 0$$

Using the Routh stability criterion, determine the range of K for stability.

**Q-2 [A]** What is Steady State Error? Explain type of the system and its relation with steady state error. Derive static error coefficients. [05]

**[B]** Draw free body diagram and analogous electrical circuit based on force-voltage analogy for the given mechanical system. [05]



**OR**

**Q-2 [A]** Write a short note on gear train system. [05]

**[B]** The open loop transfer function of a unity feedback control system is given by [05]

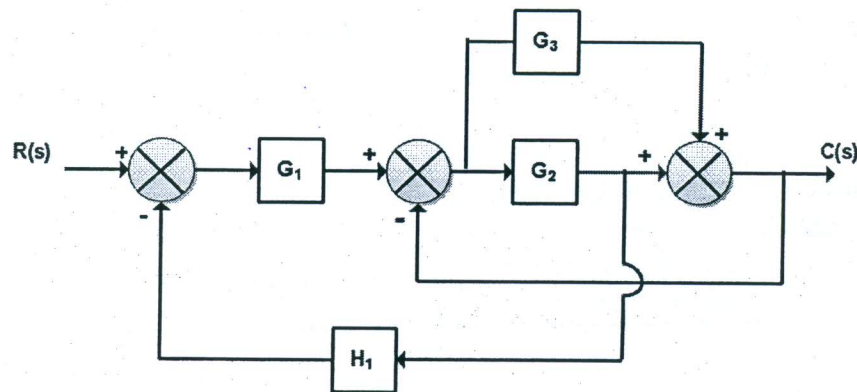
$$G(s) = \frac{25}{s(s+5)}$$

Calculate: The natural frequency of oscillations, damped frequency of oscillations, damping factor, damping ratio and maximum overshoot of a unit step input.

- Q-3 [A] Derive expression of response,  $c(t)$ , of first order unity feedback system whose closed-loop transfer function is given below, for ramp input as a function of time. [05]

$$\frac{C(s)}{R(s)} = \frac{1}{1 + Ts}$$

- [B] Determine the transfer function for the block diagram given below using mason's gain formula. [05]

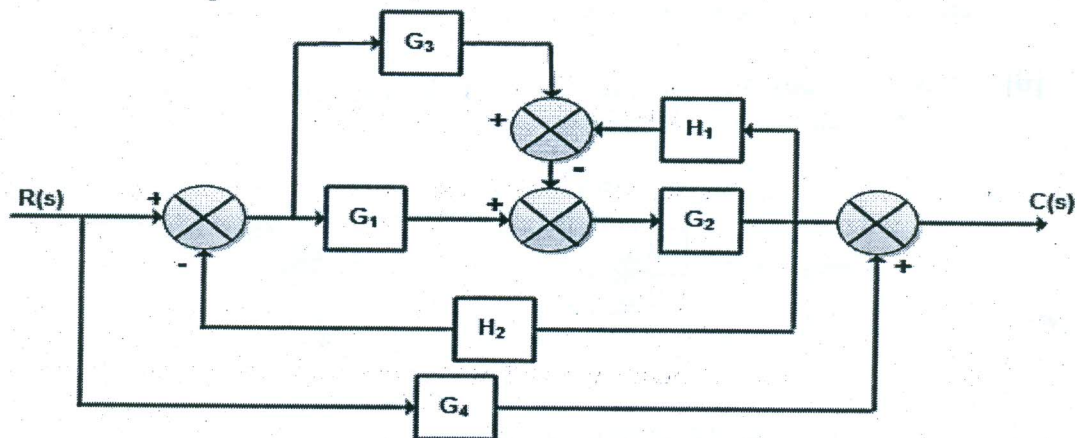


OR

- Q-3 [A] (a) Explain standard test signals used in control system. [02]

(b) What do you understand by poles and zeros of a transfer function? Relate it to stability. [03]

- [B] Determine the transfer function for the block diagram given below using block diagram reduction technique. [05]



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----- Best of Luck -----