IV / INST/CBGS/FCS / 24th NOV·16

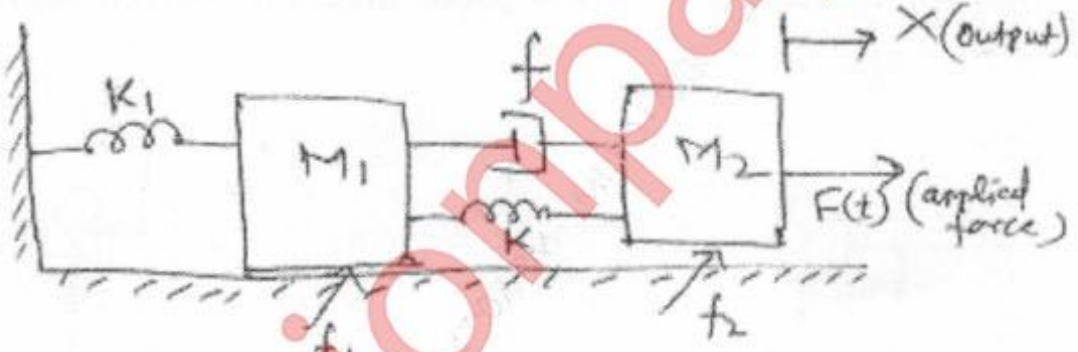
Feedback Control System **QP Code:551104**

(3 Hours) **[Total Marks :100**

N.B. : (1) Q. **1** is **compulsory.**
(2) Solve any **three** from remaining **five** questions.
(3) **Assume** suitable **Data** if **required.**

1. Attempt any **four**:- **20**
   (a) Differentiate open-loop and closed-loop system.
   (b) Explain principle of superposition and homogeneity.
   (c) Explain principle of disturbance signals.
   (d) Explain standard test signals.
   (e) What is correlation between time and frequency response.

2. (a) Obtain mathematical model for any thermal system. **10**
   (b) Obtain transfer function of mechanical systems shown in figure. **10**



3. (a) For the system represented by the following equations, find the transfer function $\frac{X(s)}{U(s)}$ by signal flow graph technique. **10**

$$x = x_1 + \beta_3 u$$
$$\dot{x}_1 = -a_1 x_1 + x_2 + \beta_2 u$$
$$\dot{x}_2 = -a_2 x_1 + \beta_1 + u$$

   (b) Derive output equation for the second-order system to the unit- step input Also draw unit-step response curves for different values of damping factor 'ξ' **10**

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4. (a) The open-loop transfer function of a unity feedback control system is given by **10**

$$G(S) = \frac{K}{(S+2)(S+4)(S^2+6S+25)}$$

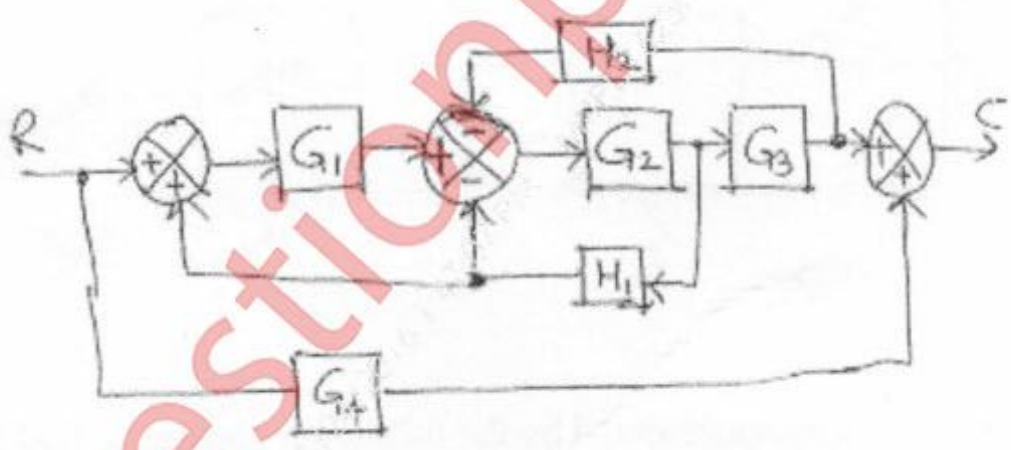
by applying Routh cristerion, discuss the stasility of the closed-llop system as a function of k- Determine the values of K which will Cause sustained oscillations in the closed-loop systems. What are the corresponding oscillation frequencies?

(b) Consider a system with an open-loop transfer function **10**

$$G(S)H(S) = \frac{K(S-2)}{(S+1)^2}$$

Sketch the Nyquist plot and conclude on closed-loop stability.

5. (a) Using block diagram reduction techniques, find the closed-loop transfer function of the system whose block diagram is given below. **10**



(b) A unity feedback control system has an open-loop transfer function **10**

$$G(S) = \frac{K}{S(S^2+4S+13)}$$

sketch the root locus of the system and determine the value of k and the frequency at which the root loci cross the jw-axis.

6. (a) Sketch the Bode plot for the transfer function given below. **10**

$$G(S) = \frac{10}{S(1+0.55)(1+0.015)}$$

determine gain margin and phase margin and comment on stability of the system.

(b) A certain system is described by the differential equation **10**

$\dddot{y} + b\ddot{y} + 4 = r$

Determine the value of b to satisfy the following specifications.

(i) Mp to be as small as possible but no greates than 15%.

(ii) Rise time 'tr' to be as small as possible but not greater than 1.2 seconds.
