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Reg. No. : ....

Name : ....

Seventh Semester B.Tech. Degree Examination, November 2013
(2008 Scheme)
08.701 : CONTROL SYSTEMS (E)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions.

1. With sketches, compare input-output configuration of open-loop and closed-loop control systems.

2. Define transfer function. What are the properties of systems whose responses can be defined by transfer function ?

3. Explain the construction and operation of tachometer.

4. Describe various standard test signals commonly used in control system design. Give time-domain and s-domain representation of the signals.

5. The transfer function of a first order process is given by $G(s) = \frac{K}{\tau S + 1}$. Find

   a) impulse response to an impulse of strength 'A' b) step response to a step of strength 'A' c) Response to a sinusoidal input $A \sin \omega t$.

6. Show with examples that introduction of derivative mode of control in a feedback system with proportional control makes it less oscillatory. What is the effect on steady state accuracy ?

7. Explain the effect of adding poles and zeros to a root locus plot.

8. Define the terms resonance peak 'M_r' and band width 'W_b' of closed-loop control system.

9. Roughly sketch the polar plot a system described by the transfer function

   $$G(s) = \frac{1}{(1 + S\tau_1)(1 + S\tau_2)}.$$

10. State Nyquist stability criterion. **(10×4=40 Marks)**

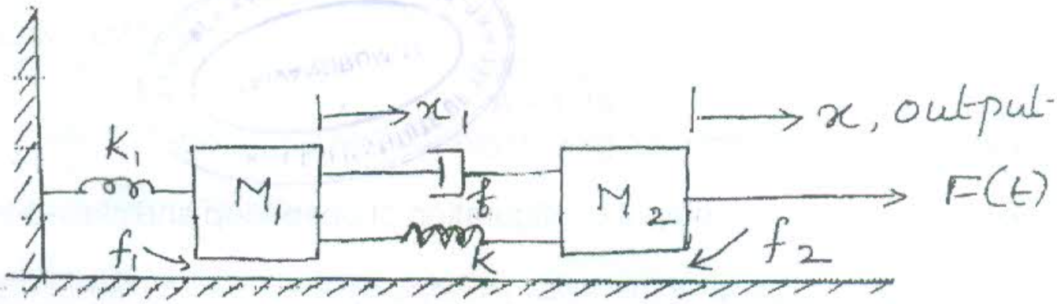
P.T.O.

PART – B

Answer **one** full question from **each** Module.

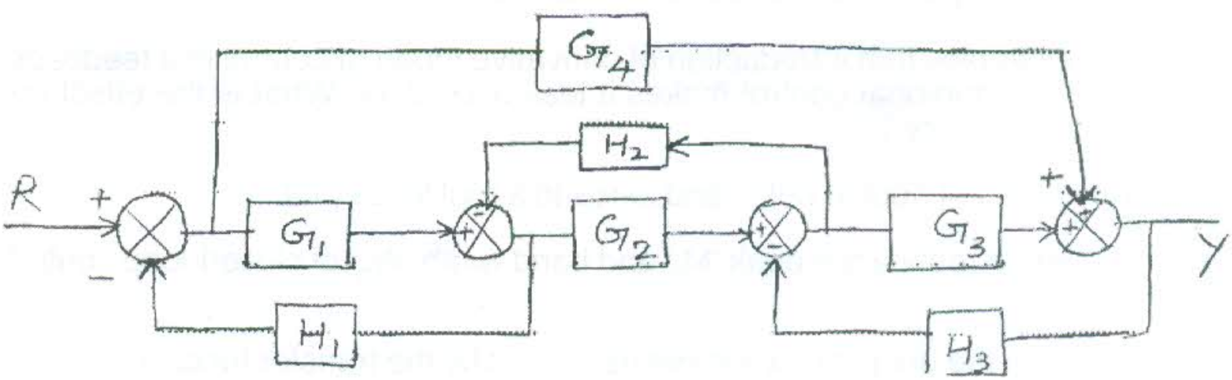
MODULE – I

11. a) Obtain the transfer function $\frac{X(s)}{F(s)}$ for the mechanical system and draw its electric analog. 10



b) Derive the expression for transfer function of a field controlled dc servomotor. State clearly the assumptions made. 10

12. a) Block diagram of a typical system is shown below. Draw its equivalent signal flow graph and find the transfer function $\frac{Y}{R}$. 10



b) Describe the construction and working of a two-phase motor suitable for use in a.c. servo systems. Draw the torque-speed characteristics and derive the transfer function model based on linearised characteristics. 10

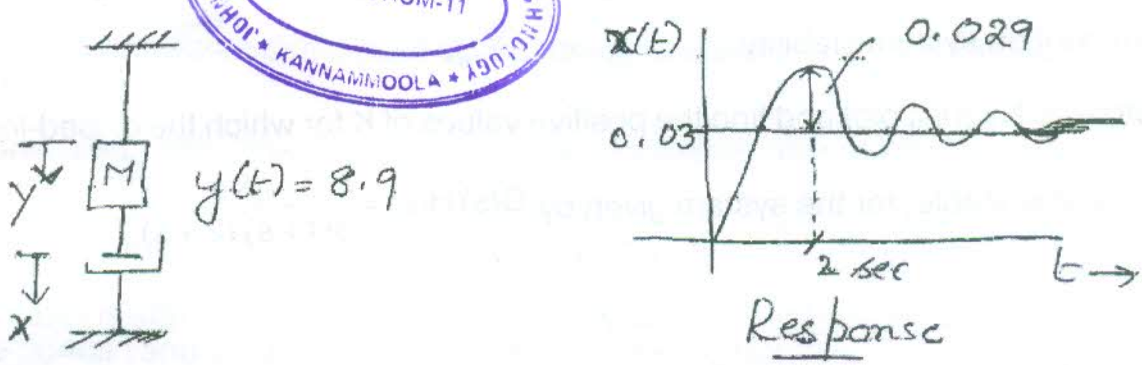
MODULE – II

13. a) The characteristic equation of a system is given by

$$S^4 + 3S^3 + 3S^2 + 2S + K = 0$$

Determine the range of values of K for which the system is stable. 10

b) Determine the values of M, B and K for the mechanical system shown from the response curve. 10



14. a) The open-loop transfer function of a control system with positive feedback is $G(s)\dfrac{K}{s(s^2+4s+5)}$. Sketch the Root-locus of the system as a function of K $(0<K<\alpha)$. 10

b) A unity feedback control system has open-loop transfer function, $G(s)=\dfrac{10}{s(s+2)}$.

Find the rise time, % overshoot, peak time, delay time and settling time for a step input of 12 units. 10

MODULE – III

15. Sketch the Bode plot for the system having the transfer function

$$G(s) = \frac{3}{s(1+0.05s)(1+0.2s)}, \; H(s) = 1.$$

Determine :

1) Gain cross over frequency and corresponding phase margin.

2) Phase cross over frequency and corresponding gain-margin.

Comment on system stability. 20

16. Sketch the Nyquist plot and find the positive values of K for which the closed-loop operation is stable, for the system given by $G(s)\,H(s) = \frac{K}{s(1+s)(2+s)}$. 20