JAYA GROUP OF INSTITUTIONS Thiruninravur-602024

4th Semester - B.E.

Model Exam I - JAN 2015

Sub. Title : **CONTROL SYSTEMS** Date 2 : 2. .2015

Sub. Code : **EC6405** Branch : **ECE**

Duration : **180 MINS** Max. Marks : **100**

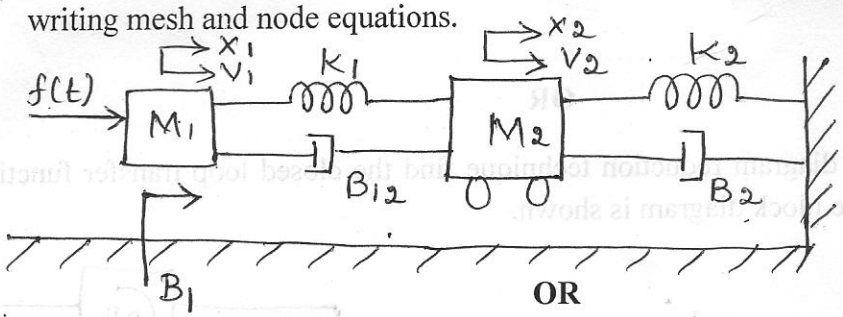
Answer all questions

Part A - (10 x 2 = 20)

1. Define (i) open loop system (ii) closed loop system.
2. What are the basic elements used for modeling mechanical translational systems?
3. Define transfer function.
4. What is transmittance?
5. Define a linear system.
6. What is time response?
7. Define step signal.
8. Define (i) transient response (ii) steady state response.
9. How is system classified depending on the value of damping ratio?
10. Define rise time.

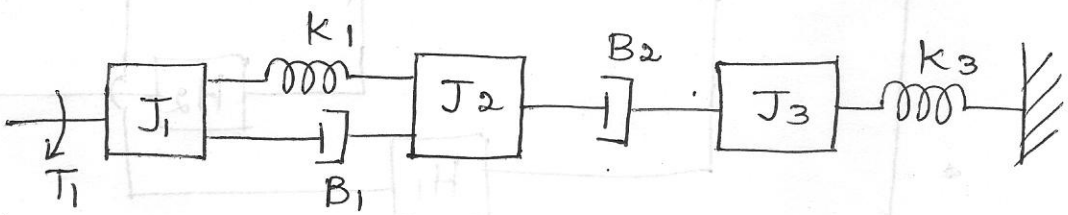
Part B - (5 x 16 = 80)

11. (a) Write the differential equations governing the mechanical system shown in figure. Draw the force voltage and force current electrical analogous circuit and verify by writing mesh and node equations. (16)



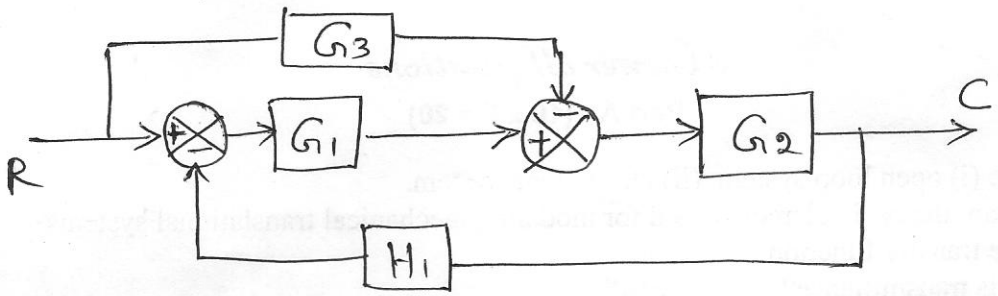
OR

(b) Write the differential equations governing the mechanical rotational system shown in figure below. (16)

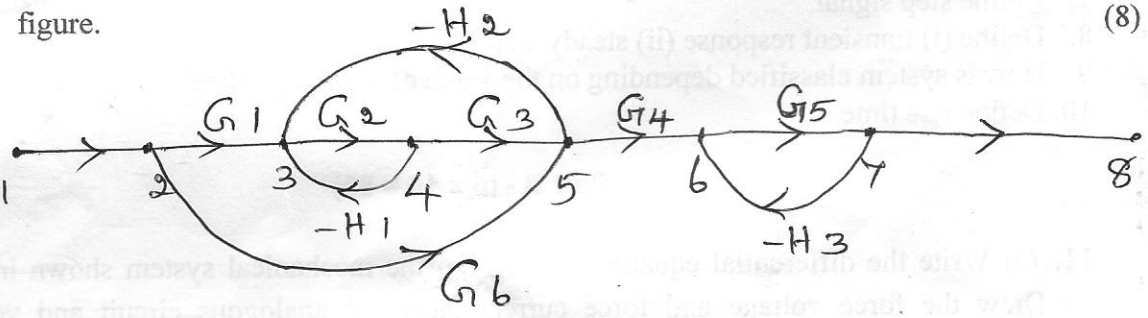


Draw the torque voltage and torque current electrical analogous circuits and verify by mesh and node equations.

12. (a) (i) Using block diagram reduction technique, find the closed loop transfer function C/R of the system whose block diagram is shown below. (8)

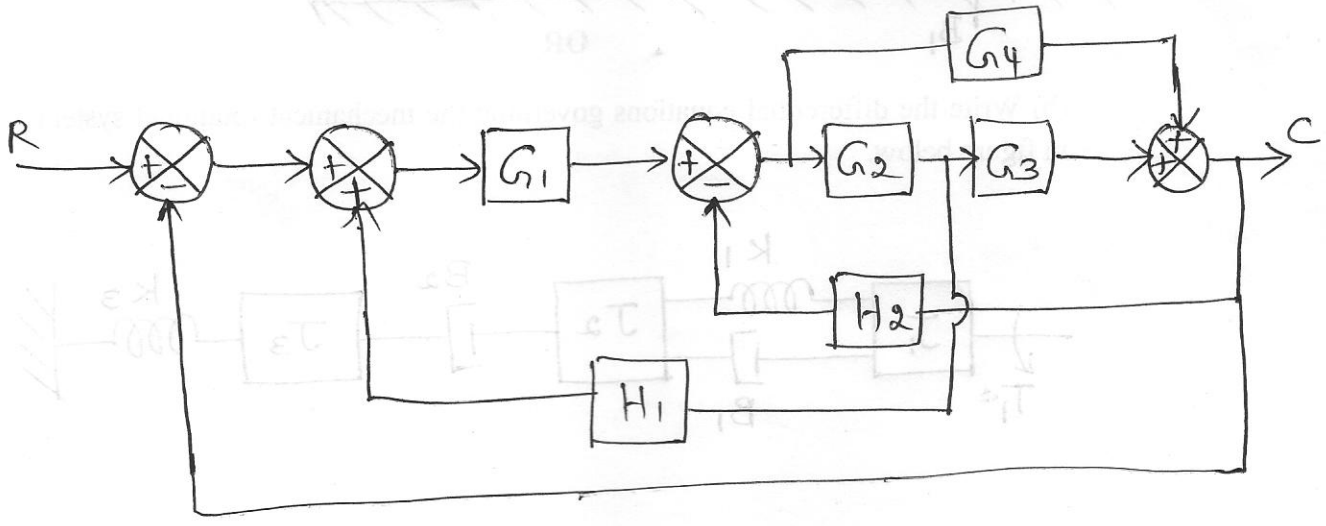


(ii) Find the overall transfer function of the system whose signal flow graph is shown in figure. (8)



OR

(b) Using block diagram reduction technique find the closed loop transfer function of the system whose block diagram is shown. (16)



13. (a)Discuss the rules to be followed when using block diagram reduction technique. (16)

OR

(b)(i) Discuss the unit step response of second order system. (8)

(ii) Obtain the unit step response and unit impulse response of the following system $C(s)/R(s) = 10 / (s^2+2s+10)$ (8)

14. (a)(i) The open loop transfer function of a unity feedback control system is given by $G(s) = k / [s(sT+1)]$ where k and T are positive constants. By what factor should the amplifier gain be reduced so that the peak overshoot of unit step response of the system is reduced from 75% to 25%. (8)

(ii) A certain unity feedback control system has the following forward path TF $G(s) = [k(s+2)] / [s(s+5)(4s+1)]$. The input applied is $r(t) = 1+3t$. Find the minimum value of k so that the steady state error is less than 1. (8)

OR

(b) A system is described by $\frac{d^2y}{dt^2} + 8\frac{dy}{dt} + 25\,y(t) = 50\,x(t)$ Evaluate the response and maximum output for a step of 2.5 units. (16)

15. (a)(i) Write short notes on dynamic error coefficients. (8)

(ii) For a unity feedback second order system, the open loop TF is $G(s) = \frac{\omega_n^2}{s(s^2+2\xi\omega_n)}$ Calculate the generalized error coefficients and find error series. (8)

OR

(b) Discuss the effect of derivative control on the performance of a second order system. (16)

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