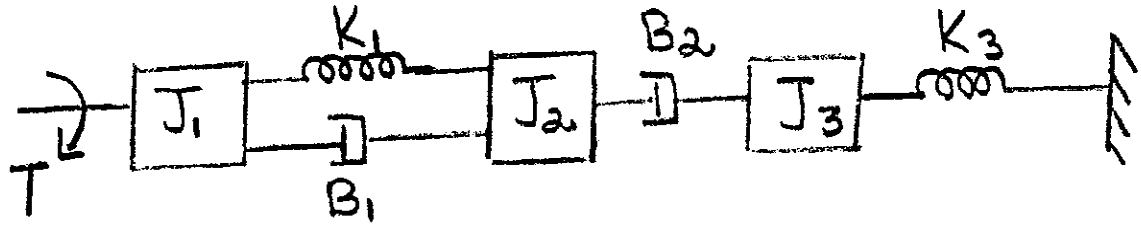
BITS, PILANI-DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY
DUBAI, UAE

C321
AAOC ~~C321~~ Control System, TEST-1 (Closed Book)

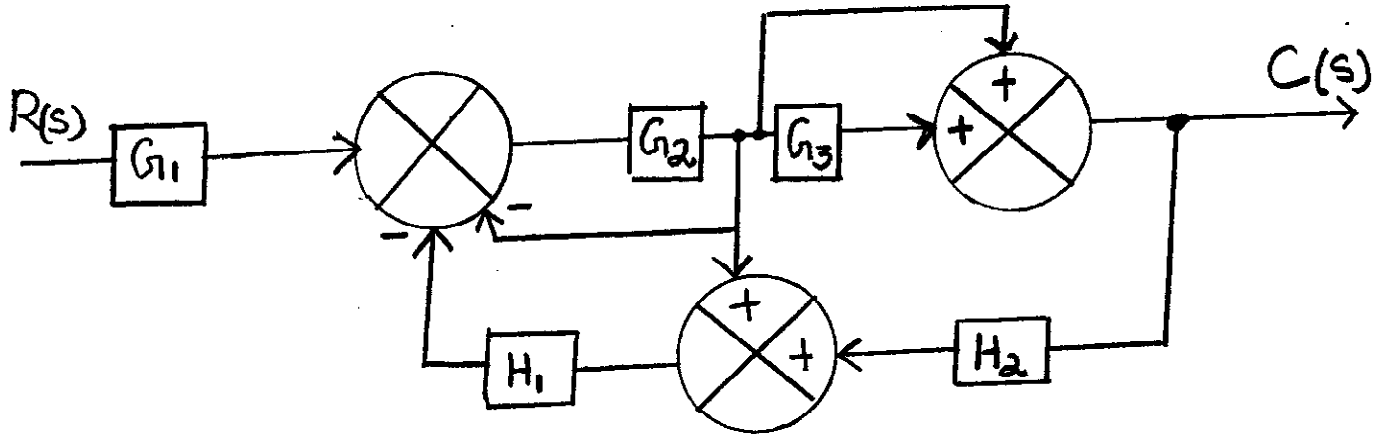
Date: 26/X/08 Weightage: 25 % Max. Marks: 25

1. Derive from the fundamentals, the Transfer Function of Field Controlled DC Servo Motor [6]

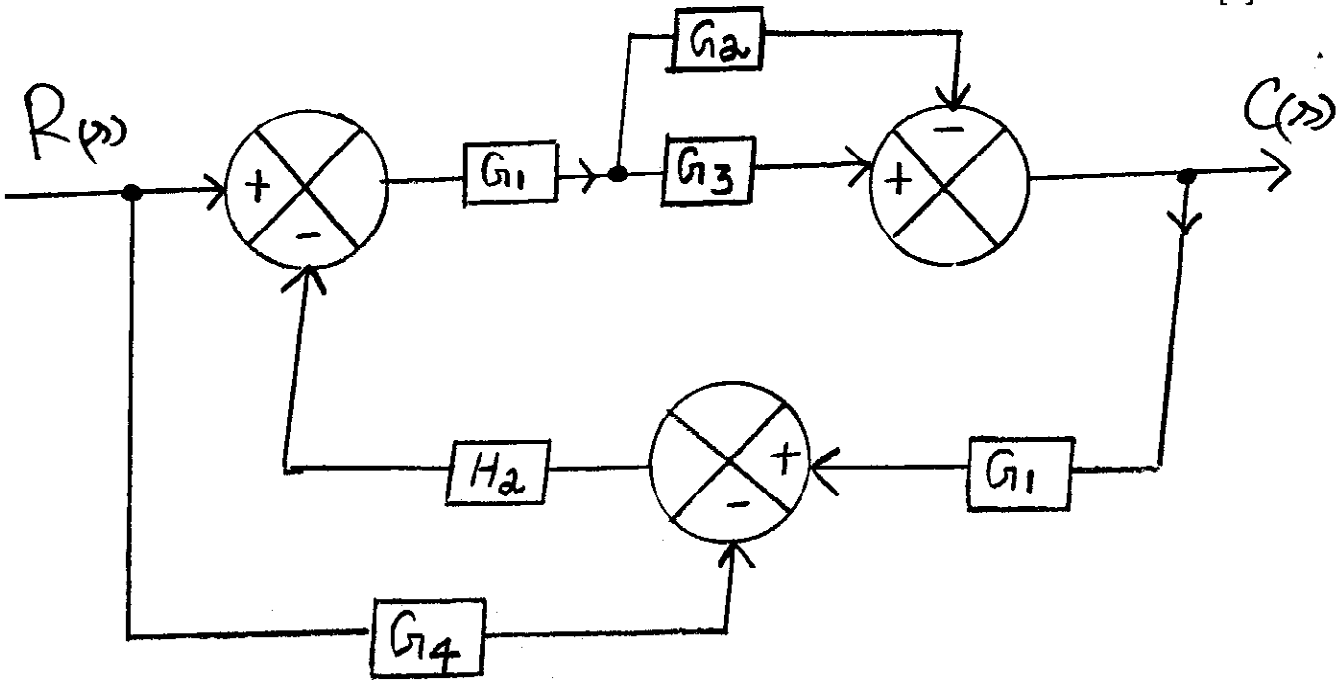
2. Write the differential equations governing the mechanical rotational system shown below. The angular displacements of J_1, J_2 and J_3 are θ_1, θ_2 and θ_3 respectively. [6]



3. Reduce the block diagram using reduction rules and obtain C(s)/ R(s) [6]



4. Find the overall Transfer Function of the following system using Mason's Gain Formula. [7]



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DUBAI, UAE

AAOC C321 Control System, TEST-2 (Open Book)

Date: 14/12/08 Weightage: 20 % Max. Marks: 20

1. Sketch the root locus for the system having $G(s)H(s) = \frac{K}{s(s+3)(s^2+2s+3)}$. Also summarize the following on the Root locus

   a) the poles of the system [1M]
   b) the angles of asymptotes [1M]
   c) the centroid [1M]
   d) the angles of departure [1M]
   e) the breakaway point in the real axis [1M]
   f) the point of intersection of root locus on the imaginary axis. [1M]
   g) rough sketch of root locus [2M]

2. A unity feedback system is characterized by the open loop transfer function [6M]

$$G(s) = \frac{10(s+2)}{(s+1)s^2}$$

Determine the position, velocity and acceleration error constants. Also determine the steady state error when the input is R(s) where

$$R(s) = \frac{3}{s} - \frac{2}{s^2} + \frac{1}{3s^3}$$

3. A unity feedback system is characterized by the open loop transfer function [6M]

$G(s) = \frac{15}{(s+1)(s+3)}$. Determine the following.

1- Characteristic equation.
2- ω_n , ξ and ω_d
3- Time at which first undershoot will occur.
4- Time period for oscillations.
5- Number of cycles(oscillations) that the output will have before settling down for a tolerance of 2% .
6- Expression for output response if subjected to unit step input.

BITS,PILANI-DUBAI CAMPUS
Academic City, Dubai
Year III – semester I 2008-2009
Quiz 1

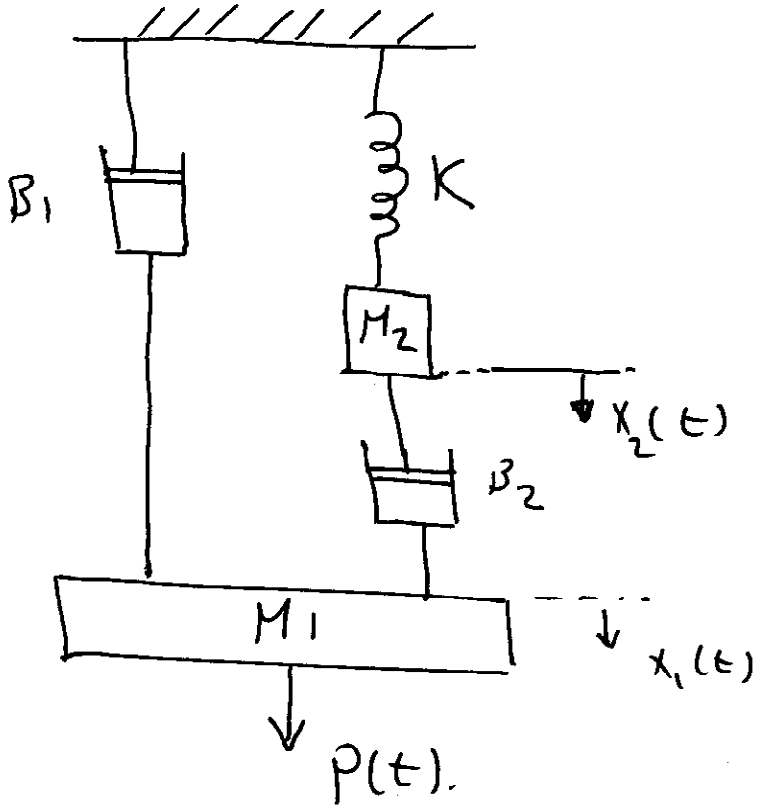
Course No. AAOC C321 Course Title : Control System
Date : September 14,2008 Time 15 minutes Max Mrks=5

NAME:---------- ID:.....

Question 1:

Draw the equivalent mechanical system [2 marks] of the given system.Hence write the set of equiliprim equations for it and obtain electrical analogous circuits using

1- F-V analogy [1.5 mark] 2- F-I analogy [1.5]



QUIZ-1
AAOC 321 CONTROL SYSTEMS

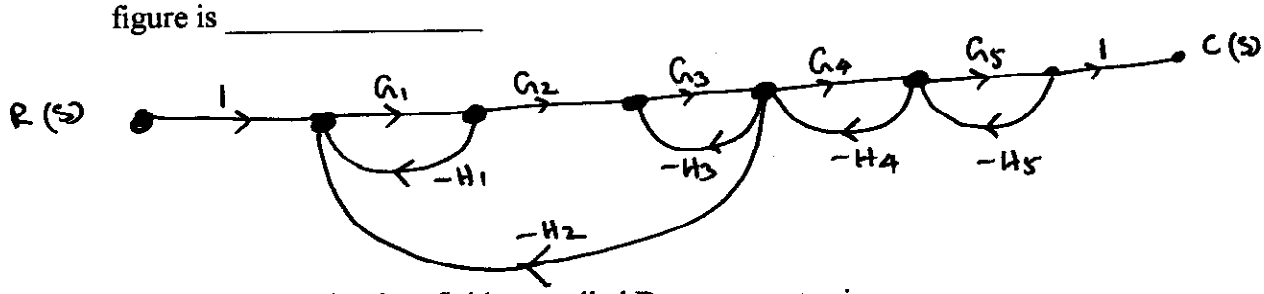
Name:_____ Register No._____

Answer All: Each Question carries 1 mark

1. A series circuit consisting of resistance R and an inductance L henry is connected in series to a supply of V(t) volts. Find the expression of current in S domain.

2. Show by diagram the procedure of shifting the take off point after a summing point

3. The Possible combination of Two Non-Touching loops in the following figure is _____



4. The torque equation in a field controlled Dc servo motor is

   A)T $\propto \phi$Ia b) T $\propto$ Ia c) T $\propto \phi$ d)None

5. Draw the SFG using the following equation

   $V_1 = 3V_1 - 5V_2 + 3V_3$, $V_2 = -6V_2 + 4V_3 - V_1$ and $V_3 = -5V_2 + 6V3$

BITS,Pilani-Dubai
International Academic City
Dubai
1st Semester,2008-09
Subject:Control Systems(AAOC C321)
3rdyear(EEE)--Quiz I--F.M.=5(5%)---Duration=10 min.- -Date -24/09/2008
Set-A

Name-- **Id No.---**

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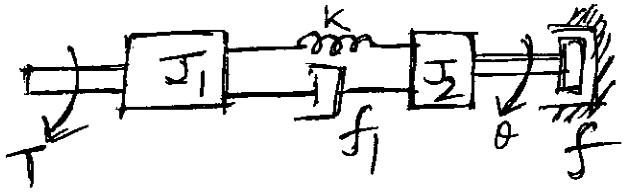
1. **Derive the expression for Transfer Function=θ(s)/T(s),with reference to the system shown in the following figure.** **[5Marks]**



Name: ID No:

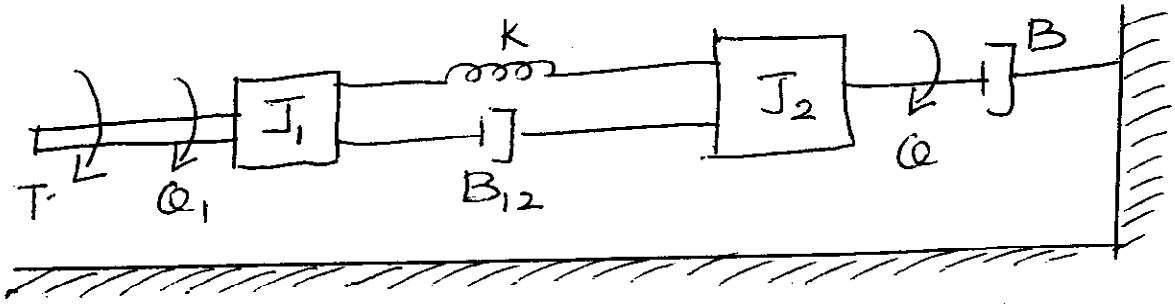
BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester I 2008-2009

QUIZ I (Closed Book)

BE (Hons) III year EIE

Course No	: AAOC C231		
Course Title	: CONTROL SYSTEM		
Date	: 18.09.08	Time: 15 Minutes	M.M = 5 (5%)

Write the differential equations of the mechanical system shown below. And also find the transfer functi



Name: ID No:

BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester I 2008-2009

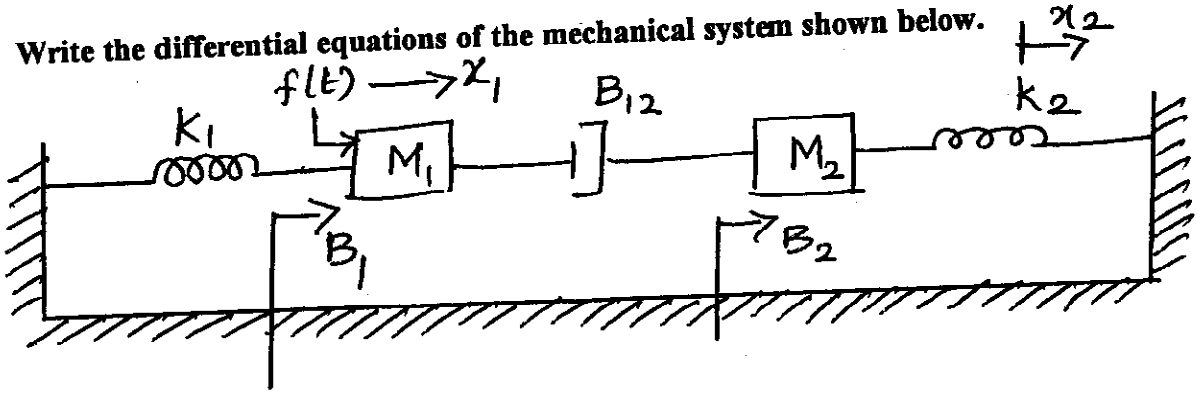
QUIZ I (Closed Book)

BE (Hons) III year Mech

Course No : AAOC C231
Course Title : CONTROL SYSTEM
Date : 18.09.08

Time: 15 Minutes M.M = 5 (5%)

Write the differential equations of the mechanical system shown below.



BITS,Pilani-Dubai
International Academic City
Dubai
1st Semester,2008-09
Subject:Control Systems(AAOC C321)
3rdyear(EEE)--Quiz II--F.M.=5(5%)---Duration=10 min.- -Date -22/10/2008
Set-B

Name-- **Id No.---**

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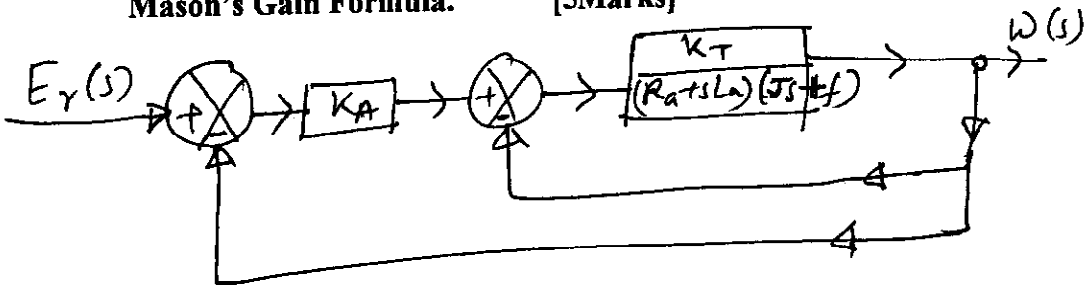
1. **Derive the expression for Transfer Function=ω(s)/E_r(s),with reference to the system shown in the following figure, using Signal Flow Graph and applying Mason's Gain Formula. [5Marks]**



BITS,PILANI-DUBAI CAMPUS
Academic City, Dubai
Year III – semester I 2008-2009
Quiz 2

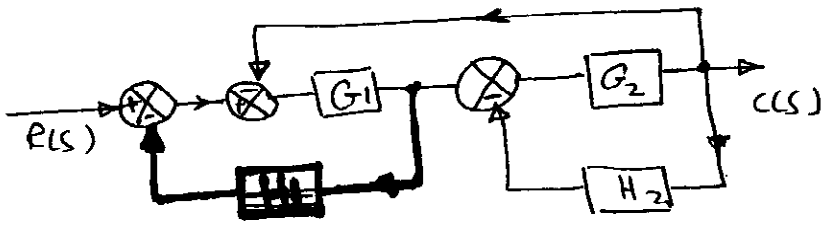
Course No. AAOC C321 Course Title : Control System
Date : October ,2008 Time 20minutes Max Mrks=5

NAME:---------- ID:.....

Question 1:

For the following Control System block diagram obtain:

1- Closed loop Transfer function C (s)/R(s) [1.5 Mark]
2- Signal flow diagram [1 Mark]
3- Mason's gain [2 Marks]
4- Output for parabolic input $r(t)= 4t^2$ [0.5 mark]



Name: **ID No:**

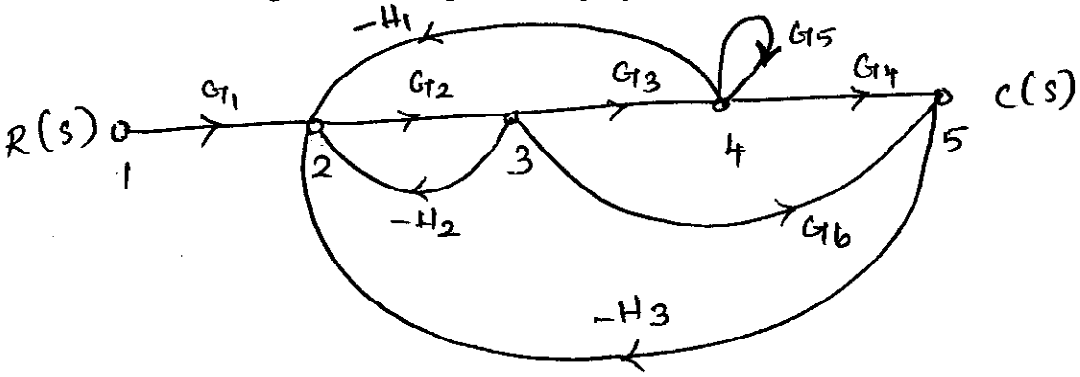
BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester I 2008-2009

QUIZ II (Closed Book)

BE (Hons) III year EIE

Course No : AAOC C231
Course Title : CONTROL SYSTEM
Date : 16.10.08 **Time: 15 Minutes** **M.M = 5 (5%)**

Find the overall gain of the signal flow graph using Mason's gain formula



BITS,Pilani-Dubai
International Academic City
Dubai
1st Semester,2008-09
Subject:Control Systems(AAOC C321)
3rdyear(EEE)--Quiz III--F.M.=5(5%)---Duration=10 min.- -Date -26/11/2008
Set-A

Name-- **Id No.---**

1.) A system has G(s)=K(s+1)(s+2)/ [(s+0.1)(s-1)] with H(s)=1 and negative feedback. Applying Routh Stability criterion, determine the range of values of K for which the closed loop system will have no poles in the right –half s-plane (i.e. number of poles of the closed loop system, in the right-half s-plane should be equal to zero).

Name: ID No:

BITS, PILANI – DUBAI

Dubai International Academic City, Dubai, UAE

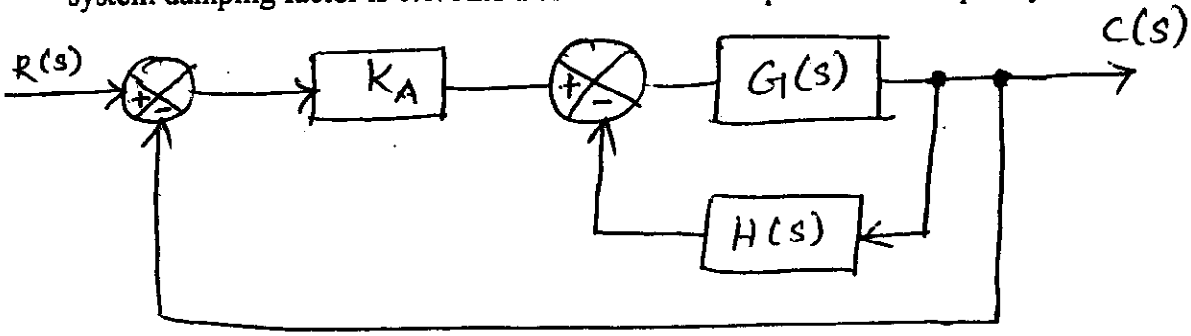
Semester I 2008-2009

QUIZ III (Closed Book)

BE (Hons) III year EIE

Course No : AAOC C321
Course Title : CONTROL SYSTEM
Date : 13.11.08 **Time: 15 Minutes** **M.M = 5 (5%)**

A unity feedback control system has an amplifier with the gain $K_A = 10$ and gain ratio $G(s) = 1/s(s+2)$ in the feed forward path. A derivative feedback, $H(s) = sK_o$ is introduced as a minor loop around G(s).Determine the derivative feedback constant K_o so that the system damping factor is 0.6. And also find the undamped natural frequency.



Name: ID No:

BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester I 2008-2009

QUIZ III (Closed Book)

BE (Hons) III year Mech

Course No : AAOC C321
Course Title : CONTROL SYSTEM
Date : 13.11.08 **Time: 15 Minutes** **M.M = 5 (5%)**

A closed loop servo is represented by the differential equation

$$d^2c/dt^2 + 8\,dc/dt = 64\,e$$

Where c is the displacement of the output shaft, r is the displacement of the input shaft and e = r-c (e is an error) .Determine the undamped natural frequency, damping ratio and percentage maximum overshoot for unit step input.

BITS,PILANI-DUBAI CAMPUS
Academic City, Dubai
Year III – semester I 2008-2009
Quiz 3

Course No. AAOC C321 Course Title : Control System
Date : November 11 ,2008 Time 30 minutes Max Mrks=5

NAME:---------- ID:.....

Question 1:

For the system shown determine % Mp and Ts when it is excited by unit step input [compare with the standard equation of second order system] [1.5 Marks]

Question 2:

Sketch the root locus for the system G(s) H(s) =k(s+4)/s(s-(-1+j)(s-(-1-j)).

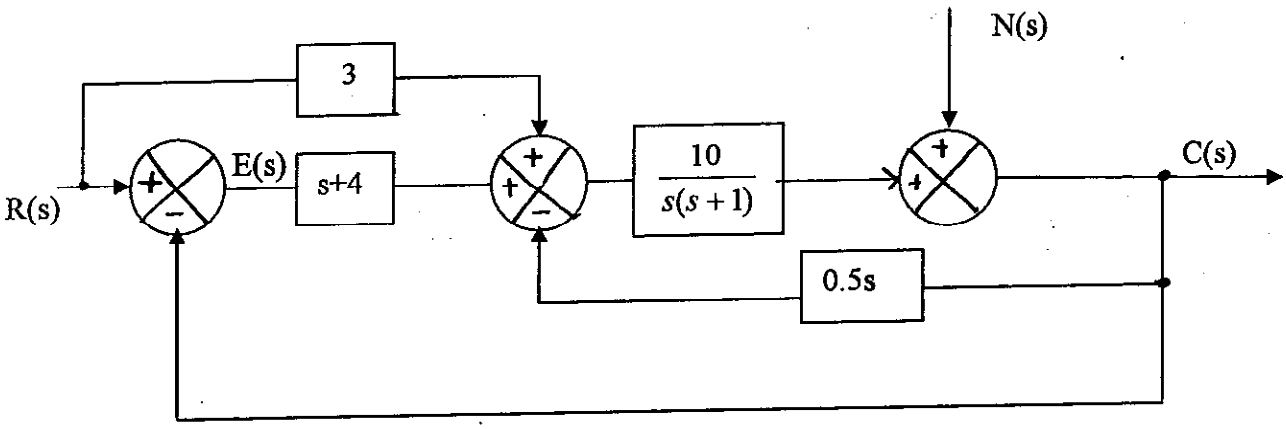
[3.5 Marks]

BITS, PILANI-DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY
YEAR – III (EEE, EIE, CS, MECH & CHEM)
SEMESTER I, 2008-2009
COMPREHENSIVE EXAMINATION

Date: 5-01-2009 Course Number: AAOC C321 Course Title: Control Systems
Time : 3 Hours Maximum Marks : 80 Weightage: 40%
Note: 1. Answer all the questions. 2. Part A, B and C in separate answer booklets.

PART A

1. Obtain $\frac{C(s)}{E(s)}$ for the system shown below, if N(s)=0. [8M]



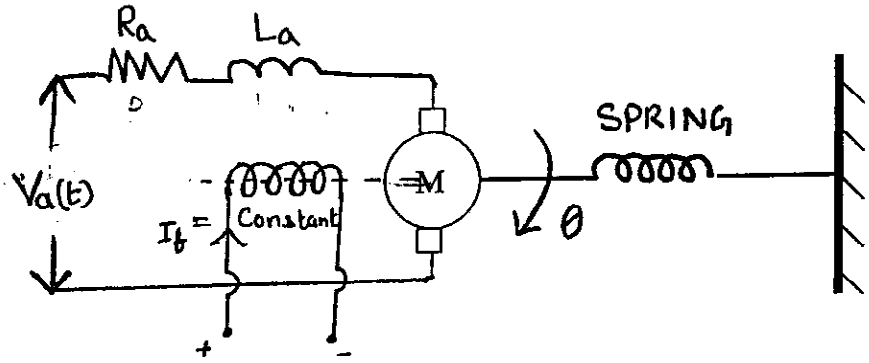
2. Determine the steady state error for the unity feedback system whose G(s)= $\frac{200}{S(S+8)}$ and r(t)=2t. Find the new value of the gain , if it is desired to reduce the existing error by 5%. [6M]

3. For the system $s^4+22s^3+10s^2+s+k=0$, using Routh array technique find K at which the system starts to oscillate .Also find the frequency of the oscillation. [6M]

PART B

4. Derive the expression **C(t)** of a second order system subjected to a unit step response for an underdamped case. [10M]

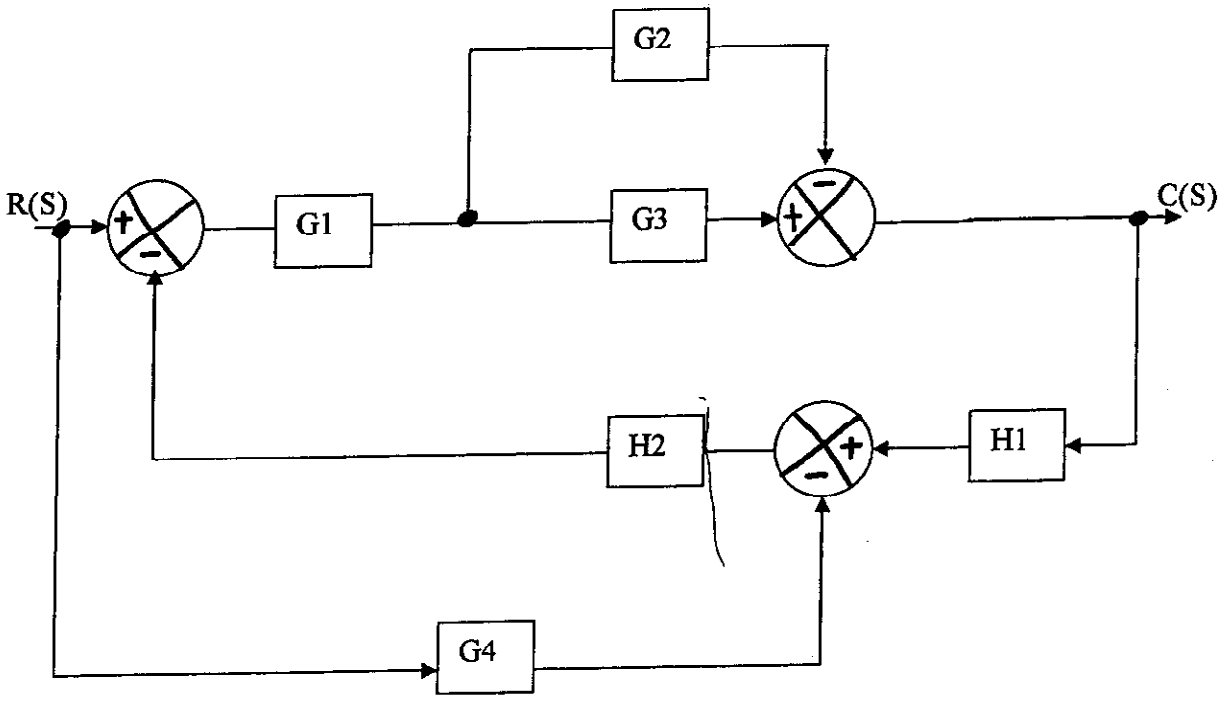
5. A d.c motor drives a pointer which is spring loaded, to return to the reference position. If K_b = Back emf constant, K_T = Torque Constant and K_s = Spring Constant & J= moment of inertia, find the Transfer Function. [10 M]



6. a) Derive the expression for sensitivity of a simple closed loop system with G(s) as the gain and H(s) as the feedback with respect to change in gain and feedback. [4M]

b) The negative feedback control system has the forward path transfer function as $G(s) = \frac{10}{s(s+2)}$ while the feedback path transfer function is 10. Determine the sensitivity of the closed loop transfer function with respect to G and H at ω= 2 rad/sec. [6M]

7. Draw the Signal Flow graph of the system represented in block diagram and by using Masons gain formula, find the closed loop Transfer function [10M]

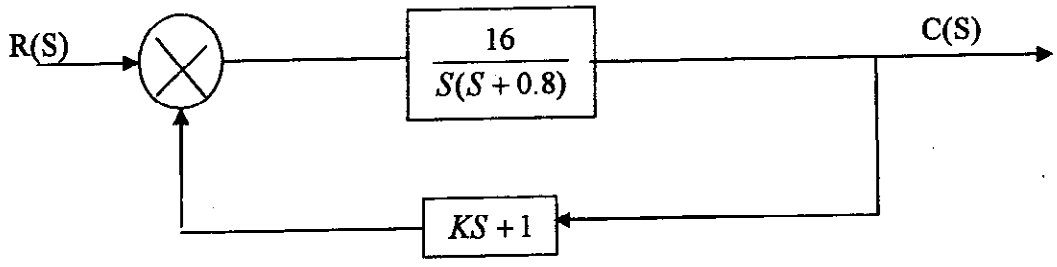


PART C

8. Sketch the root locus (Use graph sheet) for the unity feedback system whose open loop Transfer function is

$$G(s)H(s) = \frac{K(s+1.5)}{s(s+1)(s+5)}$$ [7M]

9. A positional Control system with velocity feedback is shown in figure below. What is the output response C(t) to the unit step input. Given that $\xi = 0.5$, calculate the Rise time, Peak time, Maximum overshoot and Settling Time for 2% and 5 % tolerance band. [9M]



10. The open loop transfer function of a unity feedback system is given below. Sketch the Polar plot [4M]

$$G(s) = \frac{1}{s^2(sT_1+1)(sT_2+1)(sT_3+1)}$$