Code No: 55012

R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May/June-2015
CONTROL SYSTEMS
(Common to EEE, ECE, ETM)

Time: 3hours **Max.Marks:75**

Answer any five questions
All questions carry equal marks

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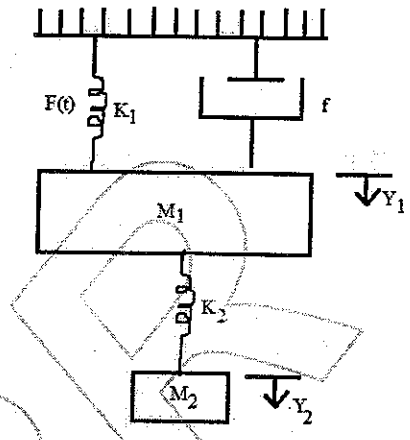
1.a) Explain the feedback characteristics of system.
b) Obtain the differential equations governing the behaviour of the mechanical system as shown in figure. Also obtain an analogous electrical circuit based on force-current analogy. [7+8]



2.a) Obtain the transfer function of armature controlled d.c motor.
b) For the system represented by the following equations, find the transfer function x(s)/μ(s) by signal flow graph technique.

$x = x_1 + \beta_2 \mu$

$\dot{x}_2 = -a_1 x_1 + x_2 + \beta_2 \mu$

$\dot{x}_2 = -a_2 x_1 + \beta_1 \mu$

[7+8]

3. The open loop transfer function of a unity feedback system in given by $G(s) = \frac{k}{s(Ts+1)}$ Where K and T are positive constants. By what factor should the amplifier gain reduced so that the peak overshoot of unit step response of the system in reduced from 75% to 25%. [15]

4. A unity feedback system is characterized by the open-loop transfer function $G(s) = \frac{k(s+13)}{s(s+3)(s+7)}$

a) Using the Routh criterion, calculate the range of values of K for the systesm to be stable.
b) Check if for k=1, all these roots of the characteristics equation of the above systems have damping factor greater than 0.5. [7+8]

5. Sketch the direct and inverse polar plots for an unity feedback systems with open loop transfer function $G(s)=\frac{1}{s(1+s)^2}$

Also find the frequency at which $|G(jw)|=1$ and corresponding phase angle $\angle$G(jw). [15]

6. Consider a system with open loop zero in right half s-plane. Let $G(s)H(s)=\frac{k(s-2)}{(s+1)^2}$

Investigate in a Nyquist plot stability of closed loop system with unity feedback.[15]

7. A unity feedback systems has open loop transfer function $G(s)=\frac{k}{s(s+1)(0.2s+1)}$

Design phase lag compensation for the systems to achieve the following specifications Velocity error constant K_v=8 phase margin=40^0. Also compare the cross –over frequency of the uncompensated and compensated systems. [15]

8.a) Define state transition matrix and give its properties.

b) Briefly explain the controllability and observability. [8+7]

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