Code No: 55012 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, February/March - 2016
CONTROL SYSTEMS
(Common to EEE, ECE and ETM)

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

Answer any five questions
All questions carry equal marks

1.a) Explain the effect of feedback on system dynamics.
b) Obtain the transfer function of the mechanical system shown in figure 1. [7+8]

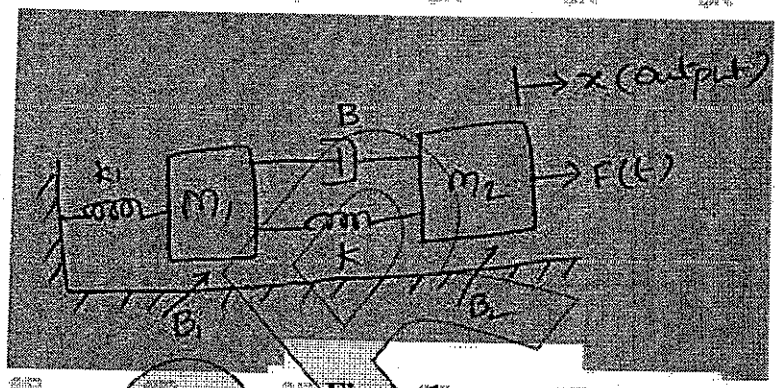

Figure 1

2.a) Derive the transfer function of ac servo motor.
b) For the circuit shown in figure 2, determine the transfer function $E_0(s)/E(s)$ from the signal flow graph. [7+8]

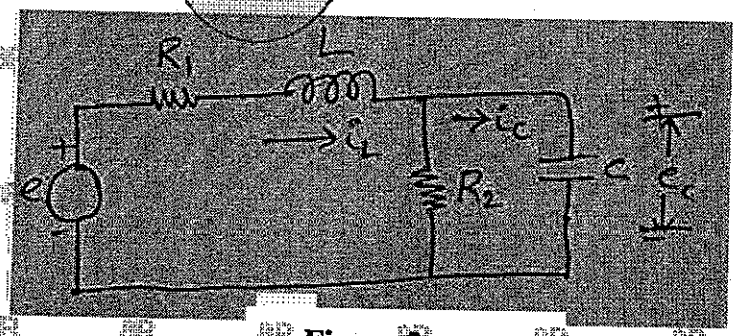

Figure 2

3.a) Explain what are PD and PI controllers. Sketch their block diagram form. List the advantages and disadvantages of their use in control systems.
b) A unity negative feedback control system has $G(s)=\frac{2(s+8)}{s(s+4)}$. Determine the closed loop transfer function. Find c(t) for unit step and unit impulse inputs. Determine the steady state value of c(t) using the final value theorem. [7+8]

4. A feedback control system has an open loop transfer function $G(s)H(s)=\frac{k}{s(s+3)(s^2+2s+2)}$. Find the root locus as k is varied from 0 to ∞.

[15]

5. Sketch the Bode plot for the transfer function $G(s)=\frac{ks^2}{(1+0.2s)(1+0.02s)}$ and determine the system gain k for the gain cross over frequency to be 5 rad/sec.

[15]

6. Sketch the polar plot of the transfer function $G(s)=\frac{1}{(1+s)(1+2s)}$. Determine whether this plot crosses the real axis or not. If so, determine the frequency at which the plot crosses the real axis and the corresponding magnitude of G(s).

[15]

7. Describe the procedure for the design of lag controllers in frequency domain.

[15]

8. Obtain the time response of the following system: $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}1\\ 1\end{bmatrix}u$

Where u(t) is a unit step function occurring at t=0 and $x(0)=\begin{bmatrix}1\\ 0\end{bmatrix}$.

[15]

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