Code No: 55012 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B. Tech III Year I Semester Examinations, December - 2014
CONTROL SYSTEMS
(Common to EEE, ECE & ETM)

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

Answer any five questions
All questions carry equal marks

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1.a) Explain the feedback effect on parameter variation.
b) Obtain the transfer function of the mechanical system shown below in figure 1.

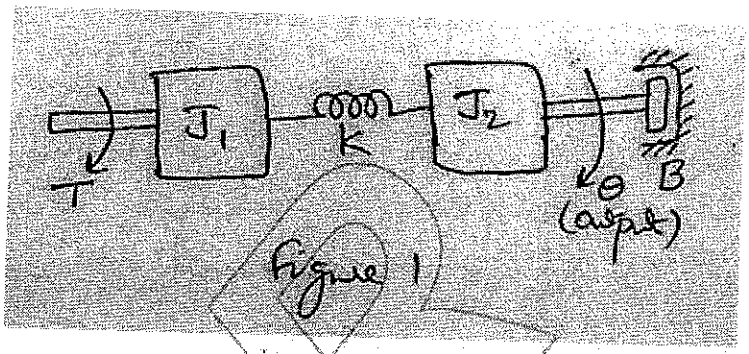

Figure 1

2.a) Derive the transfer function of field controlled dc servo motor.
b) The block diagram of a speed control system is shown below in figure 2. Determine its transfer function.

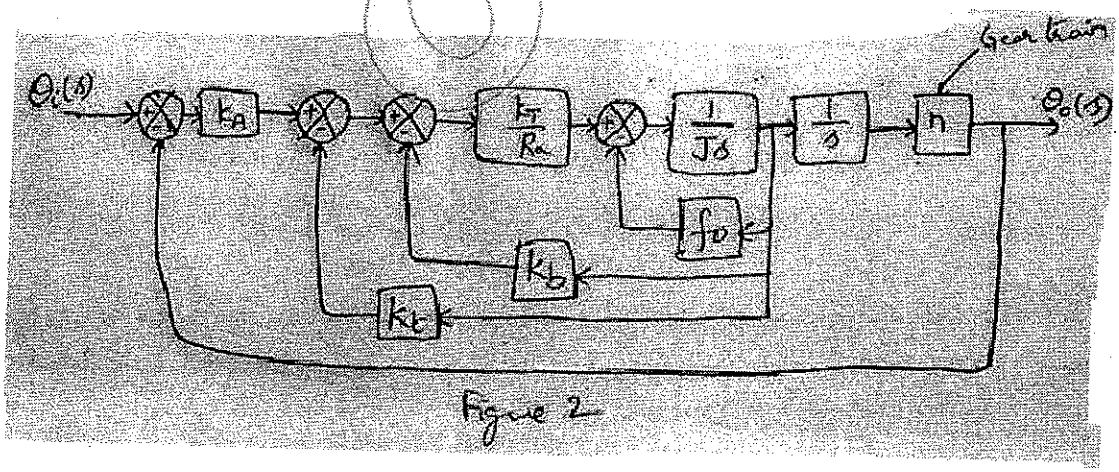

Figure 2

3.a) What is the beneficial effect of derivative error compensation on important performance indices of a type-1 control system? Elaborate.

b) A unity negative feedback control system has the plant $G(s)=\dfrac{k}{s\left(s+1.5\sqrt{k}\right)}$.

Determine its peak overshoot and settling time due to unit step input. Determine the range of k for which the settling time is less than 1 sec.

4. The open loop transfer function of a feedback system is $G(s)H(s)=\frac{k}{s(s+4)(s^2+4s+20)}$. Draw the root locus and investigate the stability of the system.

5. Sketch the Bode plot for the transfer function $G(s)=\frac{ke^{-0.1s}}{s(1+s)(1+0.01s)}$ and determine the system gain k for the gain cross over frequency to be 5 rad/sec.

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).

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

8. Consider a control system with state model $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 2\end{bmatrix}u$ Where u is unit step function and $x(0)=\begin{bmatrix}0\\ 1\end{bmatrix}$. Compute the state transition matrix and there from find the response for t>0.

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