Code No: RT31043 **R13** SET - 1

III B. Tech I Semester Supplementary Examinations, May-2017
CONTROL SYSTEMS
(Common to Electronics and Communication Engineering and Electronics and Instrumentation Engineering)

Time: 3 hours Maximum. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**
(Normal and semi & polar graph sheet are the supplied)

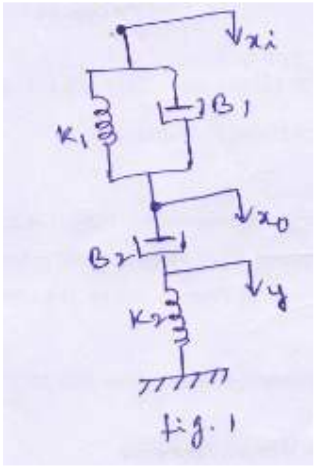
*****

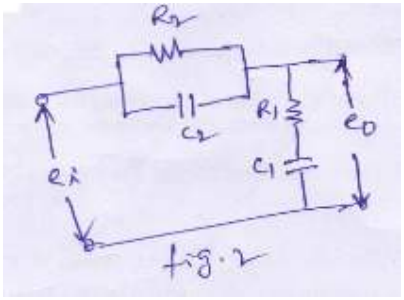
PART –A

1	a)	Write the force balance equation of ideal dashpot.	[3M]
	b)	What are the characteristics of servomotors?	[4M]
	c)	Mention two advantages of generalized error constants over static error constants.	[4M]
	d)	What is routh stability criterion?	[4M]
	e)	What are the advantages of bode plot?	[3M]
	f)	Define the controllability and obsevability.	[4M]

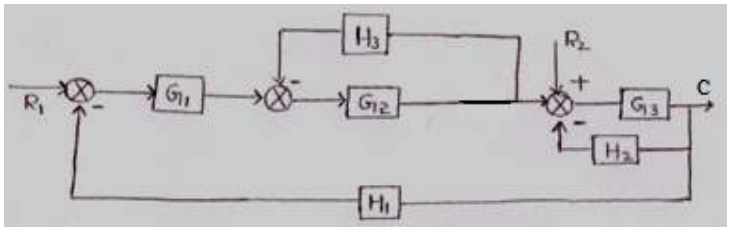
PART -B

2	a)	Define control systems. Explain the differences between closed looped and open looped system with a suitable example.	[4M]
	b)	Obtain the transfer function of the mechanical system shown in figure. Also obtain the transfer function of figure. 2. Show that the transfer functions of the two systems are of identical form and thus these are analogous systems.	[12M]





3	a)	Using block diagram reduction technique, find closed loop transfer function of the system whose block diagram is shown in figure below (i) when R1=0 and (ii) when R2=0.	[8M]



WWW.MANARESULTS.CO.IN

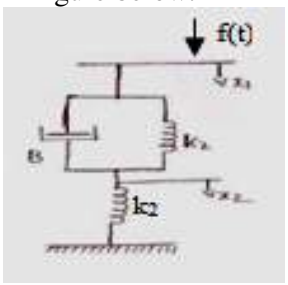
|''|'''||''||'''||||

3 b) Derive the transfer function of field controlled DC Servo motor. [8M]

4 a) The open loop transfer function of a servo system with unity feedback is [3M] $G(S) = \frac{10}{S(0.1S+1)}$. Evaluate the static error constant of the system. Obtain the steady state error of the system when subjected to an input given by the polynomial $r(t) = a_0 + a_1 t + \frac{a_2}{2} t^2$.

b) A unity feedback control system has its open loop transfer function given by 8M] $G(S) = \frac{(4S+1)}{4S^2}$ Determine an expression for the time response when the system is subjected to (**i**) Unit impulse input function and (**ii**) Unit step input function.

c) Draw the electrical analogous circuit (use f-v analogy) and derive their transfer function for the system shown in figure below. [5M]



5 a) Sketch the root locus plot for the open loop transfer function given below [10M] $G(S)H(S) = \frac{K(S^2+4)}{S(S+2)}$. Calculate the value of K at

i) break away point and **ii**) S= -0.7 +j0.9.

b) Determine the value of K such that the roots of the characteristics equation given below lie to the left of line S= -1 [6M]

$S^3 + 10S^2 + 18S + K = 0$.

6 a) Sketch the Bode plot for the open loop transfer function for the unity feedback system given below and assess stability [8M] $G(S) = \frac{50}{(S+1)(s+2)}$.

b) The open loop transfer function of a feedback control system is given by [8M] $G(S)H(S) = \frac{K}{S^2+S-2}$. Plot the Nyquist plot and show that the closed loop system is stable if $K \geq 2$.

7 a) For the system given below obtain total response $\dot{X} = \begin{bmatrix} 0 & 1 \\ -2 & -1 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$ [8M]

where $x_1(0) = 1$, $x_2(0) = 0$ and $u(t) = 1$.

b) Define state transition matrix and explain its properties with examples. [8M]

*****

WWW.MANARESULTS.CO.IN

|''|'''||''||'''||||