Seat No.	

SV - 937

Total No. of Pages : 3

T.E. Mechanical (Semester - V) Examination, April - 2018

CONTROL ENGINEERING

Sub. Code : 66241

Day and Date : Tuesday, 24 - 04 - 2018

Time : 10.00 a.m. to 01.00 p.m. **Total Marks : 100**

Instructions : 1) **All questions are compulsory.**

2) **Figures to the right indicate full marks.**

Q1) a) For the mechanical system shown in figure la, construct grounded chair representation and find equation relating f & x. **[6]**

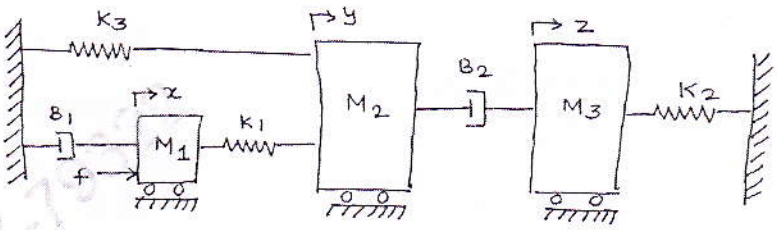

fig. 1 a

b) For the electrical circuit shown in figure 1b, construct mechanical system using direct analog. **[6]**

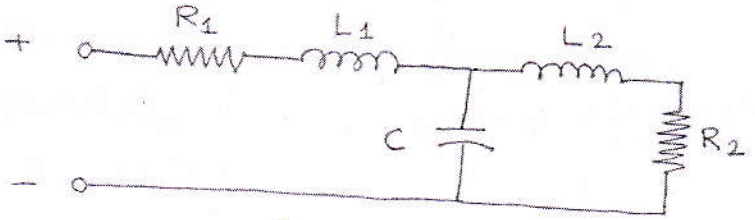

fig. 1 b

c) Obtain mathematical model of rotational system shown in figure 1c. **[6]**

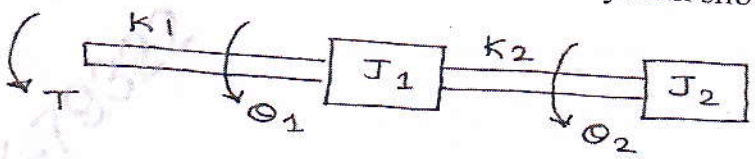

fig. 1 c

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Q2) a) Determine linear approximation for the equation used to find area of right angle triangle. Use this approximation to calculate approximate area when height (H) and base (B) of right angle triangle is 10 units and 5 units respectively. Take Hi = 12 and Bi = 4. [8]

b) Reduce the block shown in figure 2b and obtain transfer function. [8]

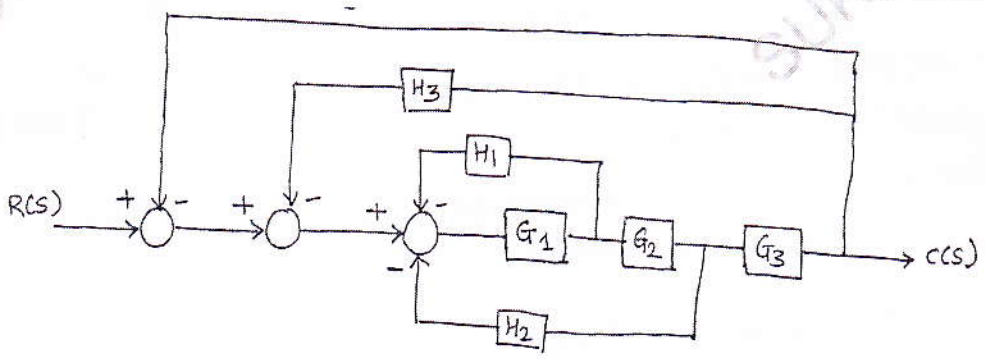

fig. 2b.

Q3) a) A unity feedback system with an integral controller is shown in figure 3a. Determine response of system when r(t) = u(t) and c(0) = $\dot{c}$ (0) = 0 [8]

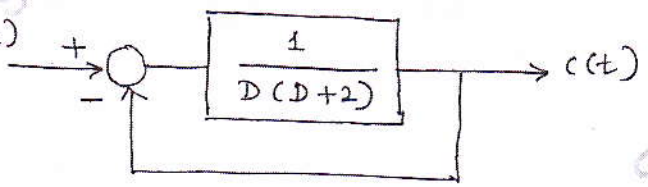

fig. 3 a.

b) Figure 3 b shows PD controller. Determine value of Td so that system is critically damped. Calculate its settling time. [8]

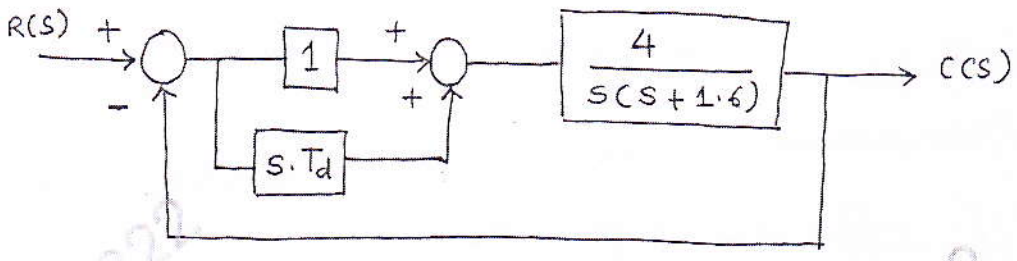

fig. 3b.

Q4) a) The characteristics equation of a feedback system is $s^4 + 20s^3 + 15s^2 + 2s + k = 0$. Find value of k if [6]

i) System is marginally stable and

ii) System is in stable condition.

b) Obtain root locus for a unity feedback system with open loop transfer function $G(s)=\frac{k}{s\left(s^2+6s+25\right)}$. [10]

Q5) a) Determine value of k and α, so that unity feedback system oscillates at a frequency of 2 rad / sec. The system has open loop transfer function

$$G(s)=\frac{k(s+1)}{s^3+\propto s^2+2s+1}$$ [8]

b) Draw Bode plot $G(s)=\frac{100(s+1)}{(s+10)(s+100)}$ [10]

Q6) a) A system is represented by $\frac{c(t)}{r(t)}=\frac{D+4}{D^2+4D+3}$, construct computer diagram and state space representation using direct programming. [8]

b) Obtain state space representation and computer diagram using parallel programming for the system having transfer function [8]

$$\frac{c(t)}{r(t)}=\frac{D+5}{(D+1)(D+2)(D+3)}$$