(iv) Determine the sensitivity of the steady state error to the changes in K. Parameters of the system are given below: $K_{pot} = 0.318$V/rad, $K_I$=100V/V a = 100, $R_a = 8\Omega$, $J_a = 0.02$ Kg-m$^2$ $D_a = 0.01$Nm-s/rad, $J_L = 1$Kg-m$^2$ $D_L$ = 1 Nm-s/rad , $K_b = 0.5$V-s/rad, $K_T = 0.5$Nm/amp. $N_1 = 25$, $N_2$=$N_3$ =250

**06**

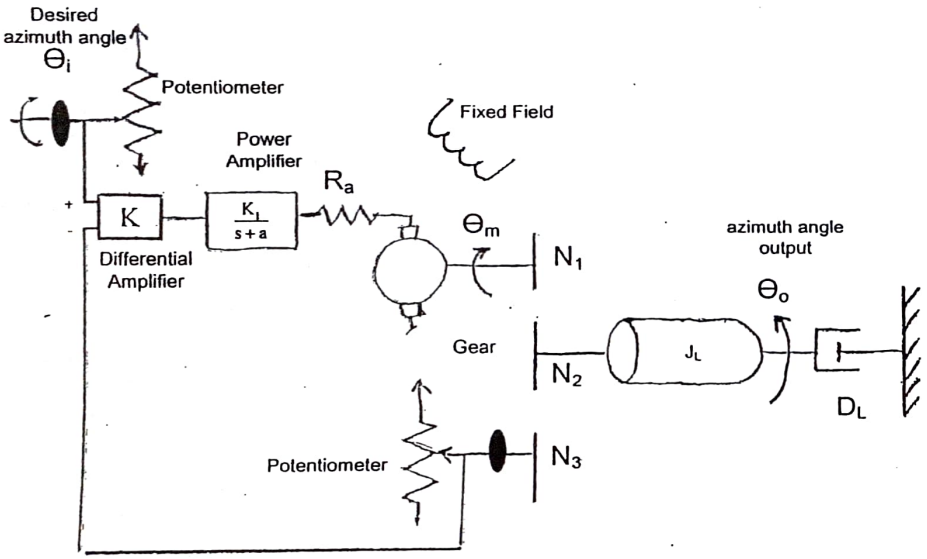



Fig. 5 Schematic Diagram of Antenna Control

Q5 A second order control system has the transfer function $T(s) = \frac{C(s)}{R(s)}$. The system specifications for a step input are given below as

(i) Percentage overshoot $\leq 5\%$.

(ii) Settling Time $< 4$ seconds

(iii) Peak Time $T_p < 1sec$

Show the permissible area for the poles of T(s) in order to achieve the desired response. Use a 2% tolerance band criterion to determine the settling time.

**04**

END

Total No. of Pages: 04 Roll No. .....

**IV Semester** **B.Tech. (EE)**

**MID SEMESTER EXAMINATION** **(March-2019)**

**EE-206 CONTROL SYSTEMS**

*Time: 1:30 Hours* *Max. Marks: 20*

**NOTE: Attempt ALL questions. Assume suitable missing data, if any.**

Q1 Write down the correct answers of the following by giving proper justifications:

(i) Find the value of K which results in no steady state error for step input in the system shown below in Fig. 1(a) whose unit-step response with K=1 is given in Fig. 1(b)

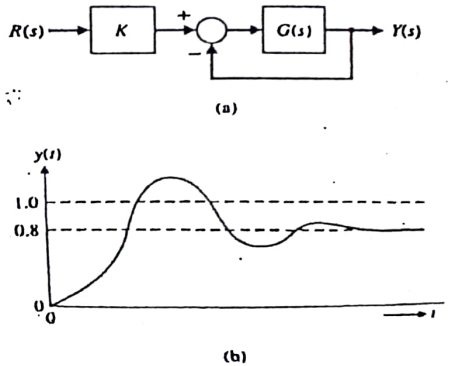



Fig. 1

(ii) The gain, time constant and sensitivity is increased by application of negative feedback

(iii) Classify the following systems as time variant/time-invariant and causal/non-causal systems

(a) $y(t) = 3x^2(t) + sint$

(b) $y(t) = x(sint)$

P.T.O

-153-

(iv) The percentage overshoot in the step response of a second order system with $\xi$ =0.1will be less compared to a system with $\xi$=0.7

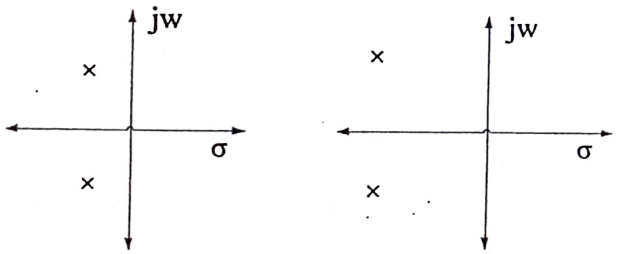
(v) Increasing the type of the system improve both the steady state response as well as transient response?

(vi) In the field-controlled mode of operation, the DC servomotor transfer function relating the shaft velocity and control voltage is a third order function.

(vii) A synchro transmitter is excited by an ac voltage of $50 \sin 100\pi t$. Plot the three voltages which appear between the different stator terminals of the synchro. Clearly mark the two axes. Are these voltages three phase?

(viii) The back emf constant of an armature-controlled dc servomotor has the units of volts/volts.

(ix) The transients in the system whose poles are indicated in Fig. 2(a) die out more quickly than the transients in the system whose poles are indicated in Fig. 2( b)




(a) (b)

Fig.2 05

Q2 Determine the transfer function $\frac{V_o}{V_i}$ of the electrical system shown below by drawing its signal flow graph and using Masons Gain formula. 2.5



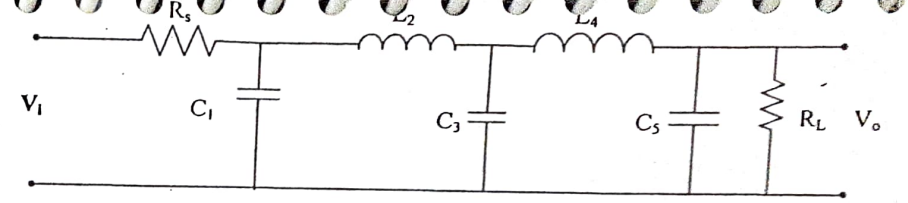



Fig. 3 Electrical System

Q3 Write the differential equations governing the motion of the mechanical system shown in Fig. 4 below and develop an electrical analogy based on force- voltage (F-V) analogy. 2.5

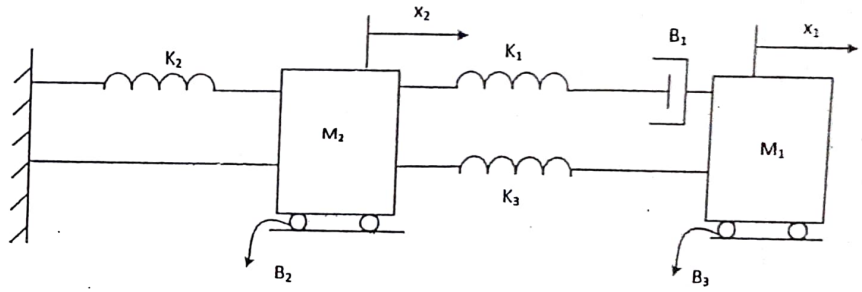



Fig. 4 Mechanical system

Q4 The schematic diagram of an antenna azimuthal control system is shown in Fig. 5

(i) Draw the complete block diagram of the system and therefrom determine the transfer function $\frac{\theta_o}{\theta_i}$

(ii) Determine the steady state error in terms of differential amplifier gain K for unit step, ramp and parabolic inputs

(iii) For what value of gain K, the steady state error due to unit ramp input will be 10%