Exam. Code: 0930
Sub. Code: 6607

2054

B.E. (Electronics and Communication Engineering)

Sixth Semester

EC-624: Control System

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: ***Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part. Missing data (If any) can be appropriately assumed.***

x-x-x

Q1 Explain briefly

A) Why is negative feedback preferred as compared to positive feedback in a closed loop system? **(2)**

B) Write the analogous electrical elements in force voltage analogy for the elements of mechanical translational system. **(2)**

C) What kind of compensation improves the steady-state error? **(2)**

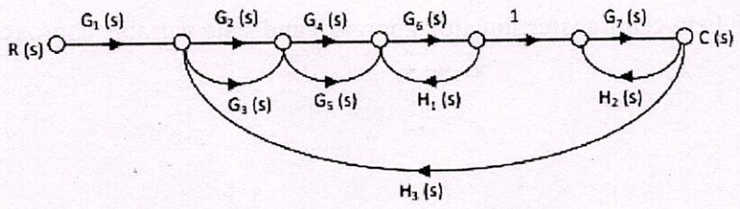
D) Is the state-model of a system unique? **(2)**

E) Which characteristic feature of the lag network is utilized for compensation? **(2)**

Part A

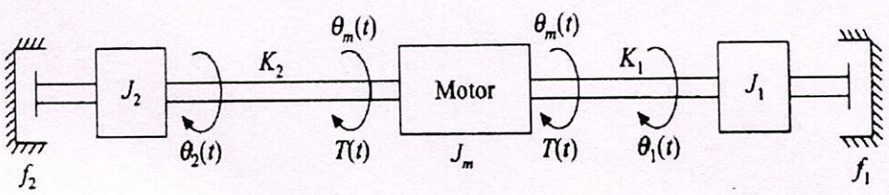
Q2 A) Write the analogy between mechanical systems and electrical systems. **(5)**

B) Using Mason's rule, find the transfer function, for the system represented by figure below. **(5)**



Q3 A) A unity feedback system has an open loop transfer function $G(s) = \frac{25}{s(s+8)}$. Determine its damping ratio, peak overshoot and time required to reach the peak output. Now a derivative component having transfer function of $\frac{s}{10}$ is introduced in the system. Discuss its effect on the values obtained. **(5)**

B) Write the torque equations of the rotational system shown in figure below. Draw the analogous electrical networks based on: (i) Torque-current. (ii) Torque-voltage analogies. **(5)**



Q4 A) The open loop transfer function of a unity feedback control system is given by: $G(s) = \frac{K(s+9)}{s(s^2+4s+11)}$. Sketch the root locus of the system. **(5)**

Contd.....P/2

B) Determine the value of for which the characteristic polynomial of a system $s^4 + 8s^3 + 24s^2 + 32s^1 + K$ has roots with zero real part. (5)

Part B

Q5 A) Sketch the bode plot for the following transfer function and determine phase margin and gain margin: (5)

$$G(s) = \frac{75(1 + 0.2s)}{s(s^2 + 16s + 100)}$$

B) Write the merits and demerits of: (i) Proportional only controller. (ii) Integral controller. (5)

Q6 A) Give the following state-space representation of a system, find Y(s): (5)

$$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ -2 & -4 & 1 \\ 0 & 0 & -6 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} e^{-1}$$

$$Y = [0 \quad 0 \quad 1]X; \quad X(0) = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

B) Draw a network of lag-lead compensator consisting of resistors and capacitors and derive its transfer function. (5)

Q7 A) Find the state equation and output equation for the system given by $\frac{Y(s)}{R(s)} = \frac{s^3+5s^2+6s+1}{s^3+4s^2+3s+3}$. Also check for controllability and observability. (5)

B) Distinguish between transfer function approach and state variable approach. (5)

X-X-X