Q.P. Code : **5440**

(3 Hours) [Total Marks :80

N.B. : (1) Question **No.1** is **compulsory**

(2) Attempt any **three** questions from remaining **five** questions

(3) Assume suitable data if necessary.

(4) Figure to the right indicate full marks

1. Answer the following. 20

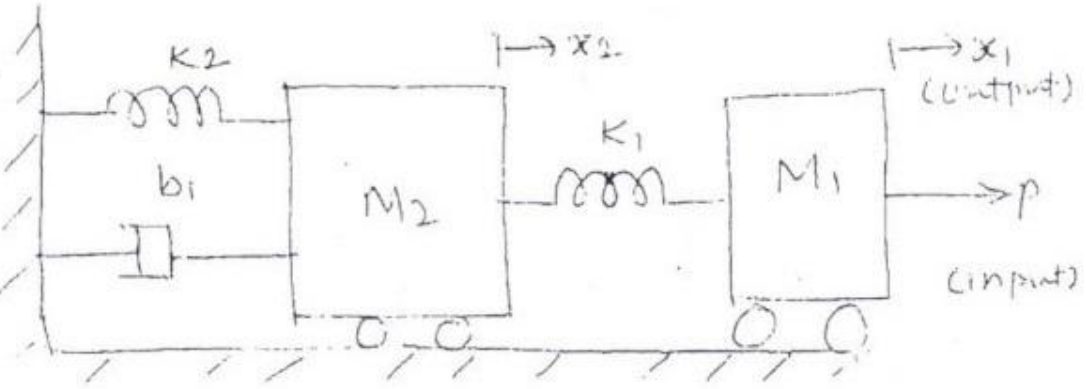
(a) Define relative and absolute stability. State its significance.

(b) Derive relationship between time and frequency domain specification of system.

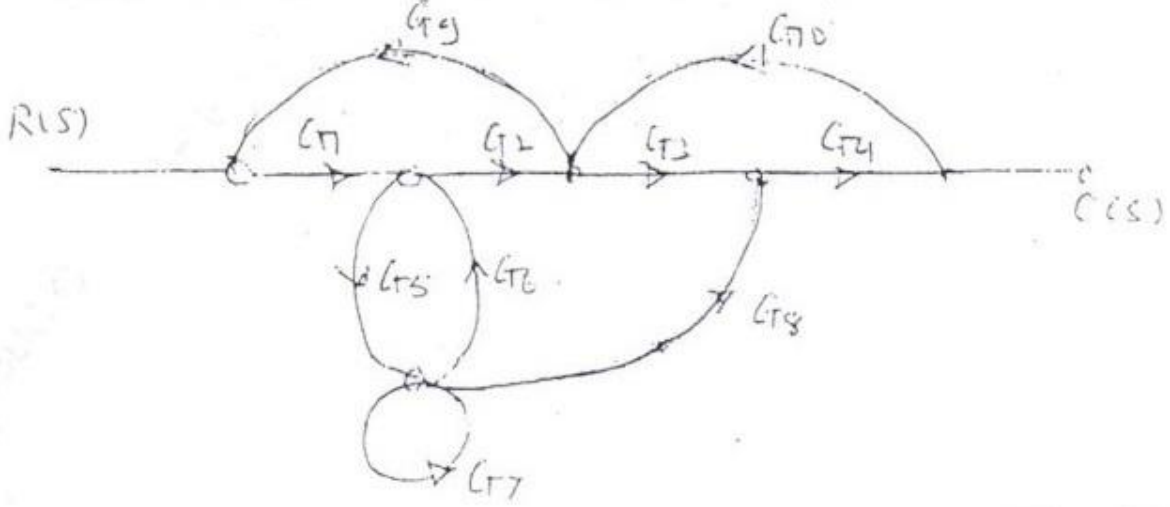
(c) Differentiate open and closed loop system

(d) Explain different types of models used in applications

2. (a) Obtain the transfer function of the following mechanical system. 10



(b) Using Mason's gain formula, find C(s)/R(s) 10



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3. (a) Construct root locus for the following transfer function. Find range of K for system to be stable $G(s)H(s)=\frac{K(S+13)}{S(S+3)(S+8)}$ 10

(b) Check controllability and observability for the system 10

$$\dot{x}=\begin{bmatrix}1 & 2 & 1\\ 0 & 1 & 3\\ 1 & 1 & 1\end{bmatrix}x+\begin{bmatrix}1\\ 2\\ 0\end{bmatrix}u$$

$$y=\begin{bmatrix}1 & 3 & 1\end{bmatrix}x$$

4. (a) Sketch the bode plot for the system described by following transfer function. Also comment on stability $G(s)H(s)=\frac{0.4(1+6S)}{S^2(1+0.5S)}$ 10

(b) Find the solution of following state equation $\dot{x}=\begin{bmatrix}-5 & -6\\ 1 & 0\end{bmatrix}x+\begin{bmatrix}1\\ 0\end{bmatrix}u$ 10

$$y=\begin{bmatrix}1 & 1\end{bmatrix}x$$

5. (a) State and prove properties of state transition matrix. 7

(b) The characteristics equations for certain feedback systems are given below. Determine range of k for the system to be stable 8

(i) $S^4+20KS^3+5S^2+10S+15=0$

(ii) $S^3+2KS^2+(K+2)S+4=0$

(c) Explain what is robust control system. Also explain the need of robust control. 5

6. (a) Explain the effects of P, I and D actions. 6

(b) Explain the effect of addition off poles and zeros to the system. 7

(c) Explain different time domain specifications. 7
