R20 Regulation *Subject code: 3P5DB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech V Semester Supplementary Examinations, June/July 2023

CONTROL SYSTEMS

(Electronics and Communication Engineering)

Maximum Marks: 70 Date:04.07.2023 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks **(10x2M=20 Marks)**

1 What are the characteristics of negative feedback?

2 What is a signal flow graph?

3 The closed-loop transfer function of a second-order system is given by $\frac{400}{s^2+2s+400}$. Determine the damping ratio and natural frequency of oscillation.

4 Why is the derivative controller not used in control systems?

5 A system has a characteristics equation $s^3 + 2s^2 + (K+1)s + 6 = 0$. Find the range of K for a stable system.

6 State the effects of adding poles to G(s) H(s) on the root loci.

7 What is all-pass and minimum-phase system?

8 When is lag compensation employed?

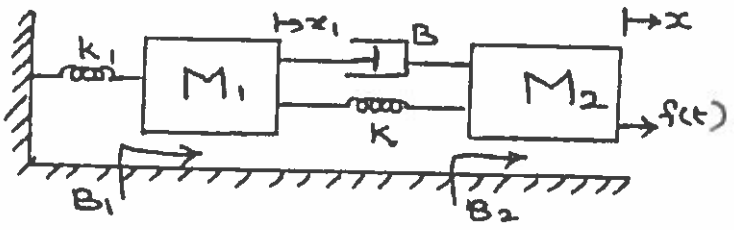
9 What is the necessary condition to be satisfied for a design using state feedback?

10 Define the controllability and observability of a system.

Part-B

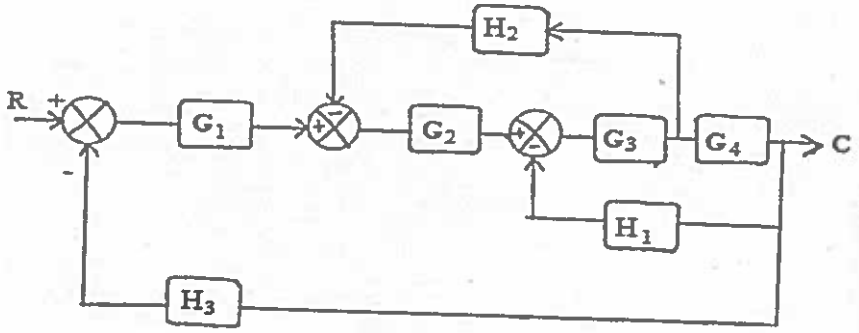
Answer All the following questions. **(10MX 5=50Marks)**

11 Write the differential equations governing the mechanical translational system shown in figure and determine the transfer function. [10]



OR

12 Explain the rules for block diagram reduction and hence find the transfer function for the following block diagram. [10]



13 Determine the steady state errors for the following inputs 5u(t), 5tu(t), $5t^2u(t)$ to a system whose open loop transfer function is given by $G(s) = \frac{[100(s+2)(s+6)]}{[s(s+3)(s+4)]}$. [10]

OR

14 Consider the second order system, where the damping ratio is 0.6 and natural undamped frequency is 5 rad/sec. Obtain the rise time, peak time, maximum peak overshoot and settling time 2% and 5% criterion when the system is subjected to a unit-step input. [10]

15 Sketch the root locus of the system whose open loop transfer function is $G(s) = \frac{K}{s(s+2)(s+4)}$. Find the value of K, So that the damping ratio of the closed-loop system is 0.5. [10]

OR

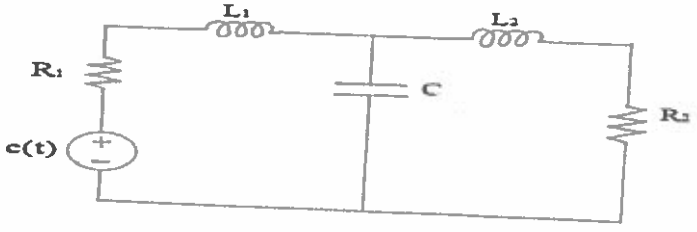
16 Sketch the magnitude and phase of the Bode plot. Determine the gain margin and phase margin of the system $G(s) = \frac{10}{s(1+0.5s)(1+0.05s)}$. [10]

17 Explain the mapping theorem and principle of argument and hence draw the Nyquist plot for the system whose open loop transfer function is $G(s)H(s) = \frac{1}{s(s+2)}$. [10]

OR

18 Explain the electric network realization of lead compensator and also its frequency. [10]

19 Obtained the state model of the electrical network shown in fig., choosing the minimal number of the state variable. [10]



OR

20 Express the state transition matrix for the state model whose system matrix A is given by [10]

$$A = \begin{bmatrix} 4 & 1 & -2 \\ 1 & 0 & 2 \\ 1 & -1 & 3 \end{bmatrix}$$