R20 Regulation *Subject code: 3P4BD*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech IV Semester Regular/Supplementary Examinations, September 2023

CONTROL SYSTEMS

(EEE)

Maximum Marks: 70 Date:24.09.2023 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 Define the transfer function in control system.
2 Write the Manson's gain formula?
3 Define steady state error.
4 Define rise time, delay time.
5 What conclusion can be made if there is a row of all zeros in the Routh array?
6 What is the effect of addition of pole to a transfer function on Root Locus?
7 What are the advantages of frequency domain analysis?
8 Explain the advantages of the lag-lead compensator
9 What are the two conditions to be satisfied by the state variables?
10 What are the merits of state variable techniques

Part-B

Answer All the following questions. (5X10M=50Marks)

11 For the system represented by the block diagram shown in figure 1. Find C/R. [10]

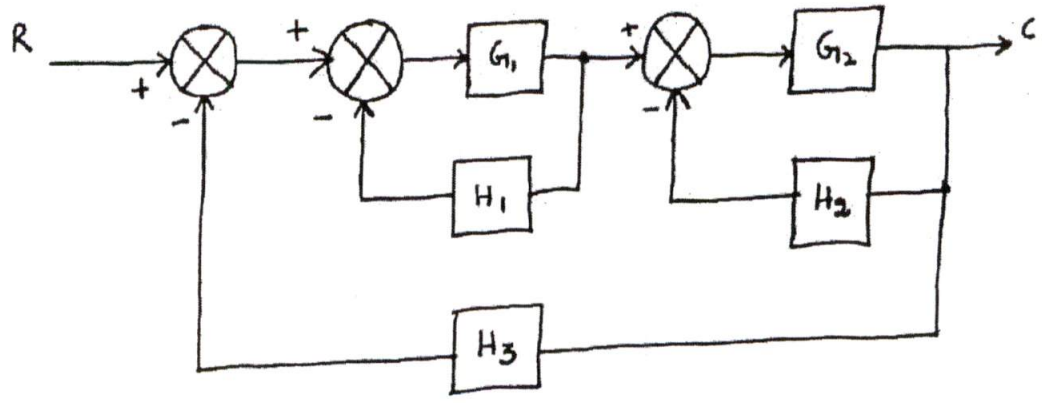

Figure.1

OR

12 A. Discuss about the mechanical translational system with an example. [5]
B. State and explain the Mason's gain formula. [5]

13 Derive an expression for the time response of a second order system excited by a unit step input. [10]

OR

14 A. Find the delay time, rise time, peak time, settling time and peak overshoot for unity feedback system with open loop transfer function. G(*S*)=16/S(S+6) [5]

B. Derive the expressions for frequency domain specifications of a second order system. [5]

15 A. Determine the stability of the system having a characteristic equation: $S^5+S^4+2S^3+3S+5=0$ [5]

B. Explain the construction rules for root locus technique. [5]

OR

16 Sketch the root locus plot of a unit feedback system with the open loop transfer function. [10]
G(S) = K/S(S+2)(S+4).

17 A. State and explain the Nyquist stability criterion. [5]

B. Explain the lag compensator and derive its transfer function. [5]

OR

18 Draw the bode plot for the unity feedback system with open loop transfer function

$$G(s)=\frac{0.5}{s(s^2+4s+3)}$$

Hence find gain margin and phase margin. [10]

19 A. Derive the expression for state transition matrix. [5]

B. Derive the expression for the calculation of the transfer function from the state variables for the analysis of system. [5]

OR

20 Check the controllability and observability of the system whose state space representations are given as [10]

$$\begin{bmatrix}\dot{X}_1\\ \dot{X}_2\\ \dot{X}_3\end{bmatrix}=\begin{bmatrix}-1 & 0 & 0\\ 1 & -2 & 0\\ 2 & 1 & -3\end{bmatrix}\begin{bmatrix}X_1\\ X_2\\ X_3\end{bmatrix}+\begin{bmatrix}10\\ 1\\ 0\end{bmatrix}u$$

$$y=[1\ 0\ 0]\begin{bmatrix}X_1\\ X_2\\ X_3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 0\end{bmatrix}u$$