R18 Regulation Subject code: 2P4DB

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech IV Semester Supplementary Examinations, September 2023

Control Systems

(ECE)

Maximum Marks: 70 Date:15.09.2023 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.
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 transfer function. What are its limitations?

2 State and explain Mason's gain formula.

3 Define peak overshoot, and settling time.

4 What are the standard test signals?

5 How R-H criterion is useful in plotting root locus?

6 What is Routh's stability criterion?

7 Draw the pole zero location of lag compensator.

8 Explain the polar plot with an example?

9 Define Controllability.

10 Define state transition matrix.

Part-B

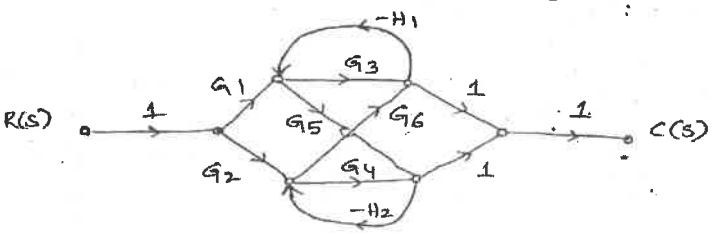
Answer All the following questions. (5X10M=50Marks)

11 a. What do you mean by the sensitivity of the control system and discuss the effect of feedback on sensitivity?

b. What is feedback? Explain the effects of feedback. (10M)

OR

12 Find the transfer function using MASON'S gain formula for C(s)/R(S). (10M)

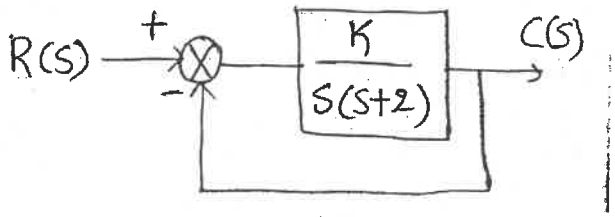


13 For a unity feedback system given by $G(s)=\frac{20(S+2)}{S(S+3)(S+4)}$. Find the steady state error for

$r(t) = 3\,u(t) + 5\,tu(t)$. (10M)

OR

14 Find the ratio of output frequencies for unit step input when K=32 &K=16 for the given closed loop control system.



(10M)

15 Sketch the root locus for the following unity feedback open loop transfer function

$$G(S) = \frac{K}{S(S+1)(s+3)(s+4)}.$$ (10M)

OR

16 Draw the Bode magnitude and phase angle plots for the transfer function $G(S) = \frac{2000(S+1)}{S(S+10)(S+40)}$ (10M)

17 Sketch the polar plot and hence find the frequency at which the plot intersects the positive imaginary axis for the system $G(S) = \frac{0.1}{S(S+1)(0.1S+1)}$. Also find the corresponding magnitude. (10M)

OR

18 Investigate closed loop stability of a system having $G(S)H(S)=\frac{K(S+4)}{S(S-2)}$ using Nyquist criterion. Determine the limiting value of 'K' for stability. (10M)

19 a. Explain the concepts of state, state variables and state model. (5M)

b.Find the state equation and state variable matrix for the following differential equation. (5M)

$$\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 10y = 5u.$$

OR

20 a. What is observability? Explain the tests for observability. (5M)

b. Check whether the system represented by

$X(t) = \begin{bmatrix} 0 & 5 \\ -1 & -2 \end{bmatrix}\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(t)$ and $y = \begin{bmatrix} 1 & 1 \end{bmatrix}\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$ is observable or not. (5M)