



Regulation 18

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

Subject code: 207BA

B.Tech VII Semester Supplementary Examinations, April 2024

ADVANCED CONTROL SYSTEMS

(EEE)

Maximum Marks: 70

Date: 29.04.2024 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 Phase Margin.
- 2 Define Lead Compensator
- 3 What is a nonlinear system?
- 4 Define asymptotic stability?
- 5 What is singular point?
- 6 What is phase trajectory?
- 7 What is saturation? Give an example
- 8 Write the describing function of dead zone and saturation nonlinearity
- 9 What are phase variables?
- 10 What is state and state variable?

Part-B

Answer All the following questions.

(5X10M=50Marks)

- 11 By Nyquist stability determine the stability of the closed loop system whose open loop transfer function is given by $G(S)H(S) = (S+2)/(S+1)(S-1)$ [10]

OR

- 12 Explain the procedure to design the Lead Compensator using Bode plot. [10]

- 13 Determine the stability of the system using Lyapunov method

$$\dot{x} = Ax \text{ where } A = \begin{bmatrix} -1 & -2 \\ 1 & -4 \end{bmatrix}$$

Find a suitable Lyapunov function. [10]

OR

- 14 Check the stability of the system described by

$$\dot{x}_1 = -x_1 + 2x_1^2 x_2$$

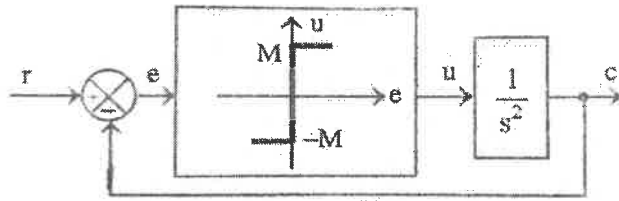
$$\dot{x}_2 = -x_2$$

Use variable gradient method. [10]

- 15 Describe the isoclines method of drawing phase plane trajectory. [10]

OR

- 16 Consider a system with an ideal relay as shown in below figure, Determine the singular point. Construct phase trajectories, corresponding to initial conditions, (i) $c(0)=2$, $\dot{c}(0) = 1$ and (ii) $c(0)=2$, $\dot{c}(0) = 1.5$. Take $r=2$ volts and $M = 1.2$ volts. [10]



- 17 Explain describing function analysis of nonlinear systems. [10]

OR

- 18 Determine and sketch the describing function for saturation nonlinearity. [10]

- 19 A) Explain the state variable and 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 Determine state model of Armature controlled DC Motor. [10]