R18

Code No: R18A0209

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech II Semester Supplementary Examinations, April 2023

Control Systems

(EEE & ECE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

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SECTION-I

1 a). Explain the advantages of signal flow graph over block diagram representation **[7M]**

b).Give any two real time examples for open loop and closed loop control systems and develop its block diagrams. **[7M]**

OR

2 a). What are the basic elements of a control system? **[7M]**

b).Describe and explain the open loop and closed loop control system **[7M]**

SECTION-II

3 a).Discuss the effect of PD and PI on performance of a control system. **[7M]**

b).A unity feed back system is characterized by an open loop transfer function $G(s) = K / s (s+5)$. Determine the gain K so that the system will have a damping factor of 0.7. For this value of K, determine the natural frequency of the system. It is subjected to a unity step input. Obtain the closed loop response of the system in time domain. **[7M]**

OR

4 a).Define the steady state error and error constants of different types of inputs **[7M]**

b).Damping factor and natural frequency of the system are 0.12 and 84.2 rad/sec respectively. Determine the rise time (tr), peak time (tp), maximum peak overshoot (mp) and settling time (ts). **[7M]**

SECTION-III

5 a).Explain the Routh's criteria with an example. What are its limitations? **[7M]**

b).Determine the stability of the closed loop system whose open loop transfer is $5 (2s+1) / [s(s+ 1)(1+ 3s)(1+ 0.5s)]$, using Routh-Hurwitz criterion. **[7M]**

OR

6 A unity feedback system has an open loop function $G (s) = K / s (s2+3s+10)$ make a rough sketch of root locus plot by determining the following (i) Centroid, number and angle of asymptotes (ii) angle of departure of root loci from the poles, (iii) Breakaway points if any, (iv) points of intersection with jw axis and (v) maximum value of k for stability. **[14M]**

SECTION-IV

7 a).Explain the frequency domain specifications of a second order system. **[7M]**

b).Given the open loop transfer function of a unity feedback system $G(s) = 1 / s (1+s) (1+2s)$. Draw the Bode plot and measure the gain margin and Phase margin. **[7M]**

OR

8 Determine the value of the gain constant K for the system with open loop transfer function G(s) = K / s(1+0.2s) (1+0.01s) so that it has a phase margin of about 350 . For this value of K, find the new gain margin using polar plot. **[14M]**

SECTION-V

9 Determine the state transition matrix for the system $\dot{X} = AX$, where **[14M]**

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

OR

10 The state equation of a system is given by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -3 & 1 \\ -2 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t), t > 0$$

a) Is the system controllable? **[5M]**

b) Compute the state transition matrix **[5M]**

c) Compute $x_1(t)$ under zero initial condition and a unit step input. **[4M]**

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