Total number of printed pages:2 **Programme(D)/V-Semester/DECE-513B**

2023

Control Systems and PLC

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Utilize graph paper and semi-log paper as needed for the questions in the exam. Please note that these materials will be provided by the invigilator.

*Answer **any five** questions.*

1.		Using the Routh Hurwitz criterion comment on the stability of the following system for which the open loop transfer function is A) $G(s)H(s) = \frac{2}{s+2}$ B) $G(s)H(s) = \frac{2}{s^2(s+2)}$ C) $G(s)H(s) = \frac{2}{s(s+2)}$ D) $G(s)H(s) = \frac{2(s+1)}{s(s+2)}$	5+5+5+5= 20
2.	a	Highlight the key difference among the following methods of analyzing the stability of a control system in frequency domain. a) Routh Hurwitz Criterion b) Root Locus c) Nyquist plot d) Bode plot	10
	b	(i) Why do we need a semi log paper for Bode plot? Highlight the importance of semi log axis. (ii) For open loop transfer function $G(s)H(s)=(s+1)$ take at least 5 values of s in s-plane and draw the corresponding values in $G(s)H(s)$-plane.	5+5

3.		For the following open loop transfer function draw the Nyquist plot by generating at least five points in *G(s)H(s)*-plane also comment on the stability of the control system. $$G(s)H(s) = \frac{1}{s(s+1)}$$	20
4.		A unity feedback control system has an open loop transfer function $$\mathrm{G}(s)\mathrm{H}(s) = \frac{K}{s(s+4)}$$ Draw the root locus and determine the value of K, if the damping ration ζ=0.707.	20
5.		Construct the Bode plot of the system for which the open loop transfer function is $$G(s)H(s) = \frac{4}{s(1+0.5s)}$$ Also comment on the stability of the control system based on the values of gain margin and phase margin.	20
6.		The open loop transfer function of a unity feedback control system is given by $$G(s) = \frac{K}{s(sT_1+1)(sT_2+1)}$$ Applying Routh Hurwitz criterion determine the value of K in terms of *T1 and T2* for the system to be stable.	20