EXPRIMENT – 6.

POLAR PLOT.

AIM :-

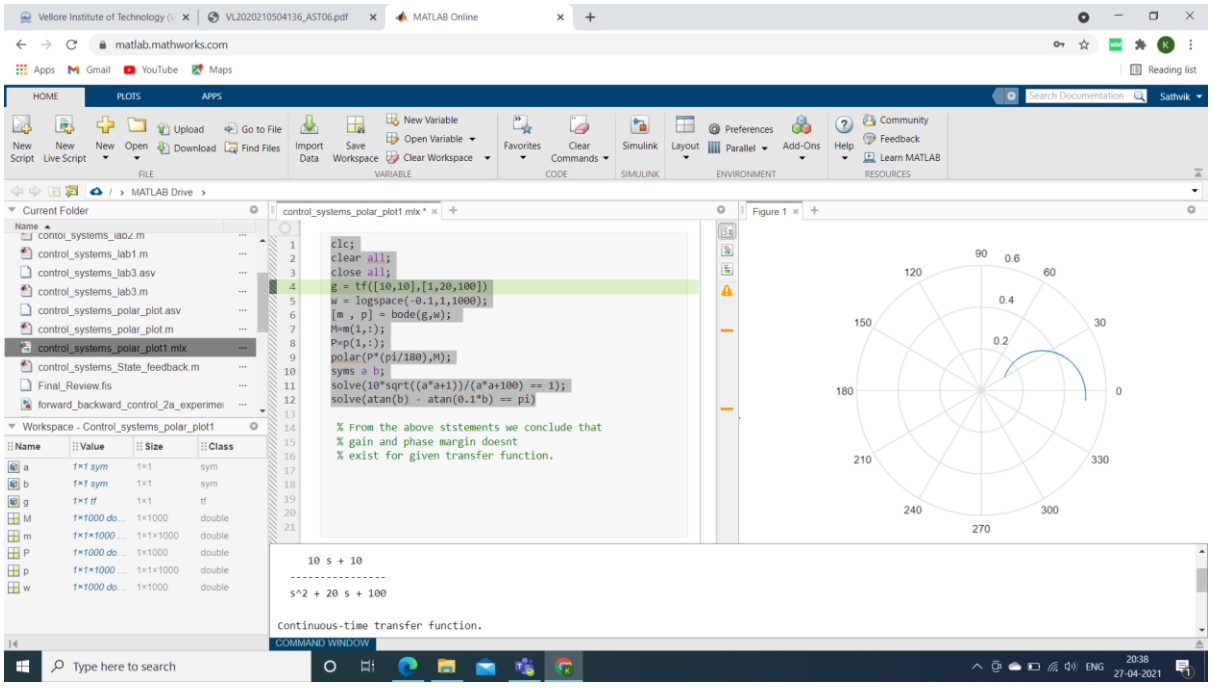
To compute polar plot, Phase margin and Gain Margin for the given Transfer function.

$$\frac{10(1+s)}{(s+10)^2}$$

Apparatus Required :-

Matlab, Polar plot, logspace(), tf(), Bode().

MATLAB PROGRAM :-



MANUAL CALCULATION :-

Q. Given Transfer function.

$$G(s) = \frac{10(s+1)}{(s+10)^2}$$

The Magnitude for the given thing is

$$|G(s)| = \frac{10}{100} \times \left| \frac{(s+1)}{(0.1s+1)^2} \right|$$

$$= \frac{1}{10} \times \frac{\sqrt{1+\omega^2}}{(0.1\omega)^2+1)}$$

and phase is

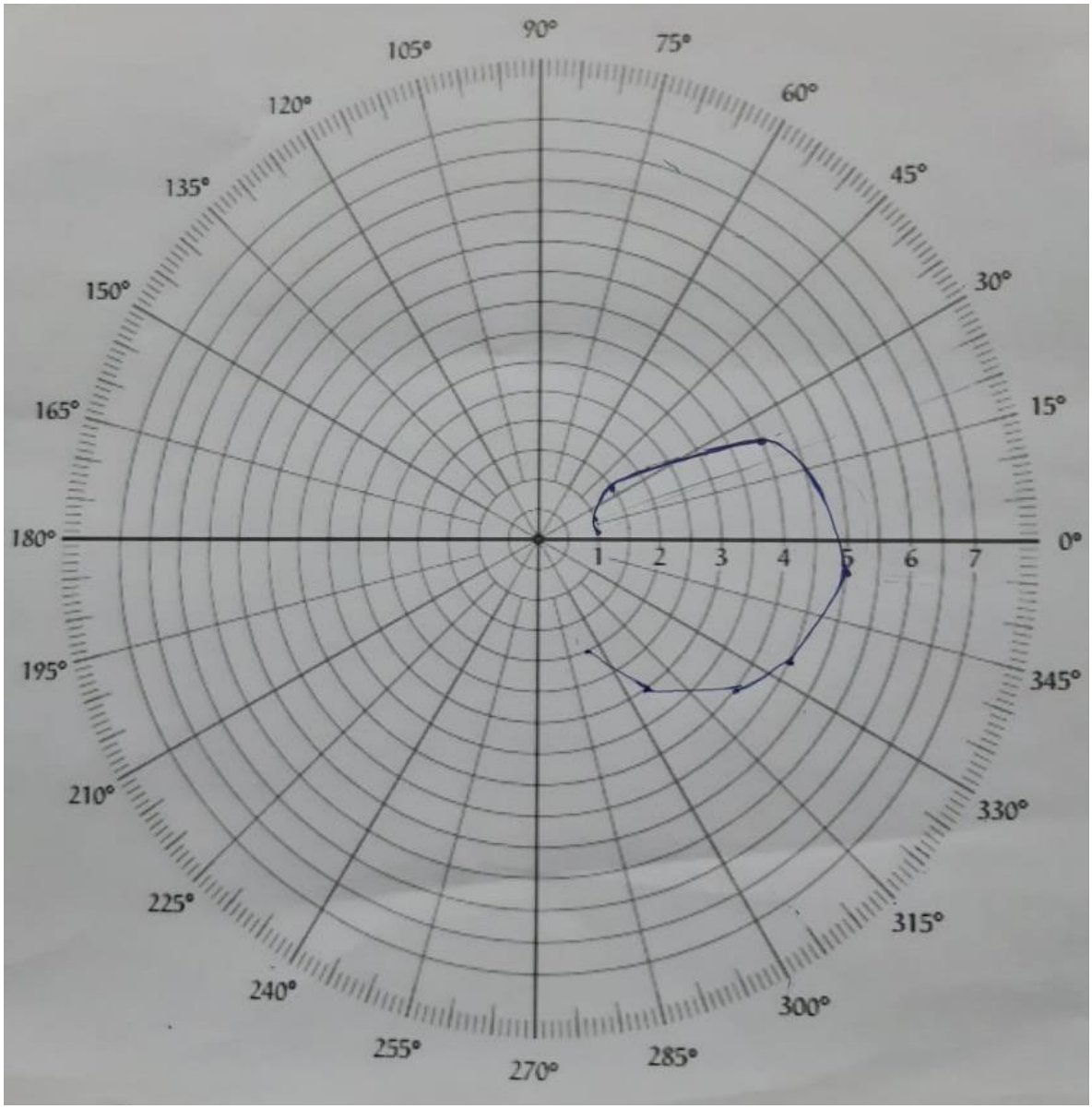
$$\tan^{-1}(\omega) - 2\tan^{-1}(0.1\omega)$$

ω	0.1	0.5	1	5	10	15	20	30	40	50	100
M	0.100	0.111	0.14	0.4	0.5024	0.463	0.400	0.3	0.2	0.2	0.1
ϕ	4.56	20.84	33.5	25.55	-5.21	-26.4	-39.7	-55	-63.35	-68.5	-79.15

Here if we want to Calculate gain margin then the ϕ must be 180° for that gain value if calculate so for Magnitude is no magnitude value it crosses 180 so the system no Gain Margin. should cross for ∞ value of Magnitude so $\frac{1}{\infty} = 0 \rightarrow$ Gain Margin

as $\therefore$ Gain Margin $= \frac{1}{\text{Gain at } \pm 180°}$.

Phase Margin is for which Magnitude is 1, Here the highest magnitude is 0.5024 which not 0 is less than 1 so there is no phase margin.



RESULT :-

The experiment is done in Matlab and Gain margin is computed as 0 and phase margin is not defined.

INFERENCE :-

Manual calculations matches with the Matlab calculations and they are verified.